The Journal of Obstetrics and Gynaecology of the British Empire

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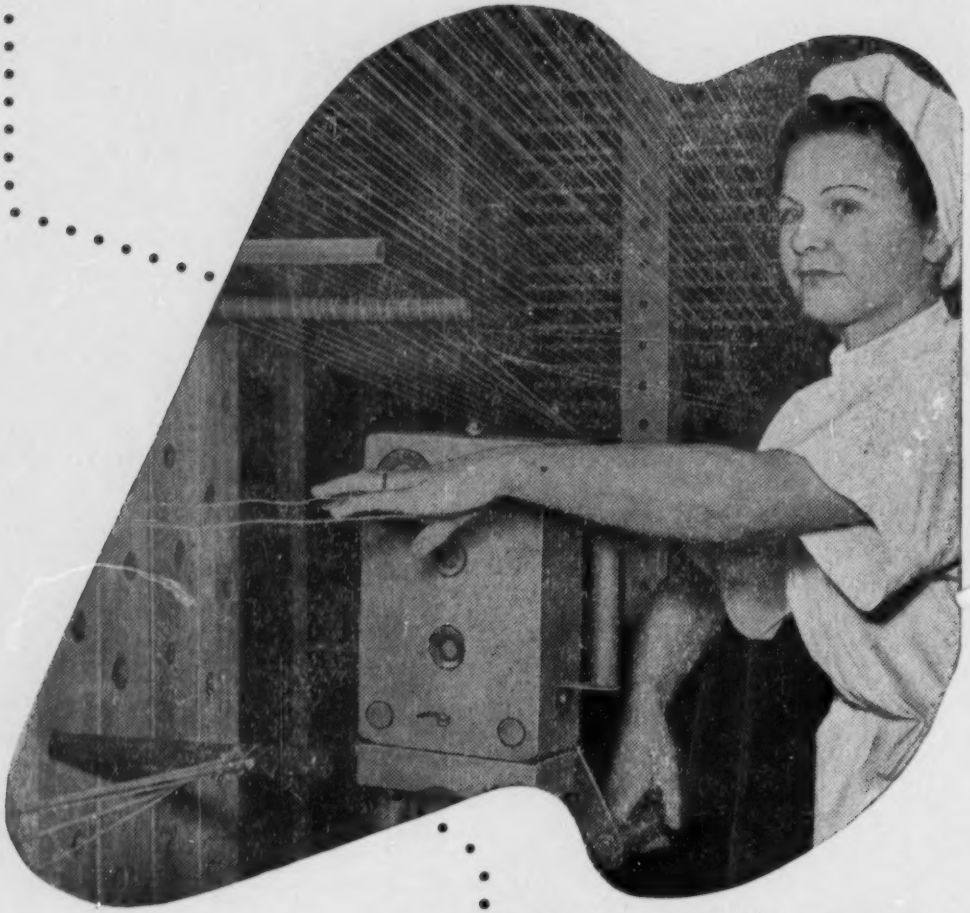

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2. A Method of Contraception Without Diaphragm—A Two-Year Investigation. Ann. New York Acad. Sc. 54:825 (May) 1952.
3. Talladega County Health Department, Alabama. Unpublished Data, March 1952.

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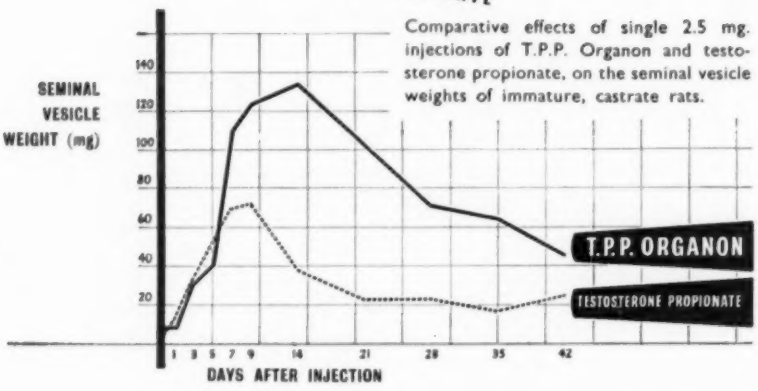

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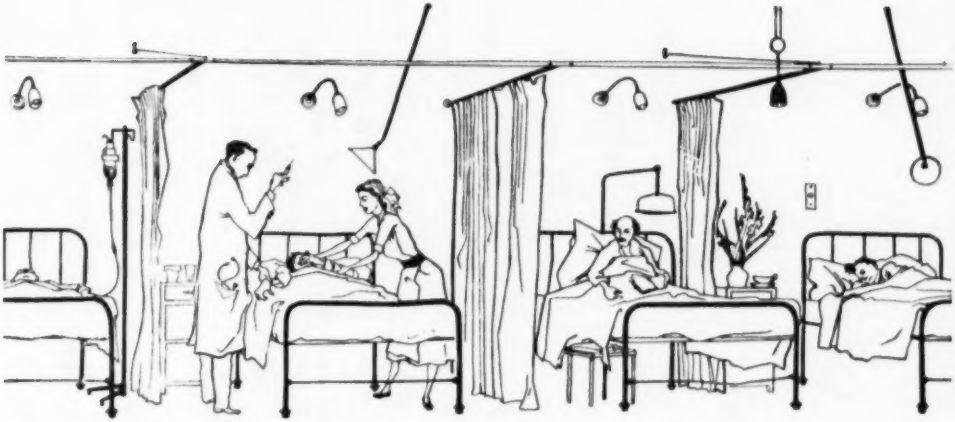

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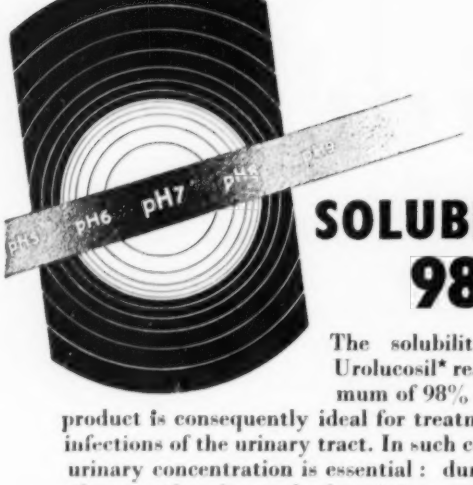

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Brown, H. E., and Jones, B. K. (1943): *J. Obstet. Gynaec. Brit. Emp.*, **50**, 128.

Sampson, P. (1940): *Obstetrics for Midwives*, 2nd edition. Fraser, London. p. 9.

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[1] O'Sullivan. *The Practitioner*, No. 986, August 1950

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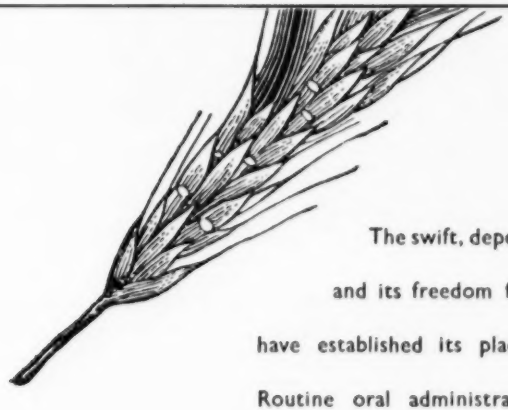

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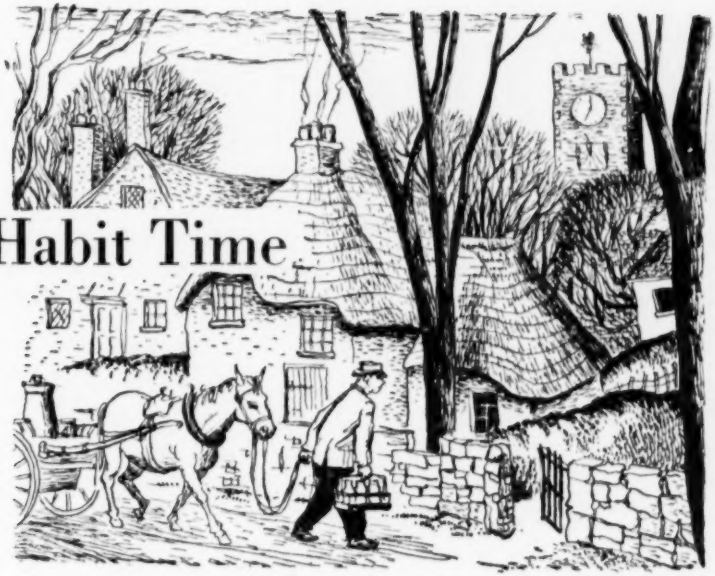

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In the article **Cancer of the Body of the Uterus** by M. A. VAN BOUWDIJK BASTIAANSE (*Proceedings of the Thirteenth British Congress of Obstetrics and Gynaecology*, Vol. LIX, No. 5, October 1952, page 616) " Number of cures " in Table XI should read " Number of cases " and " Total number of cures " in Table XII should read " Total number of cases ".

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Chief Surgeon, Woman's Hospital, New York

VESICOVAGINAL fistula was considered incurable until about 100 years ago. The accomplishments of surgeons who, during the first half of the 19th century, developed successful techniques for relief of this condition constitute one of the most fascinating chapters in the history of medicine. Lacking all the facilities which are now regarded as essential for the comfort, safety and success of modern surgery, it seems incredible that they could have mastered this complicated surgical problem.

We can hardly fail to wonder at the perseverance, ability and skill of these pioneers. They had no knowledge of surgical asepsis or the bacterial origin of infections. New instruments had to be designed and constructed to carry out surgical techniques which they had devised. Establishment of the efficiency of suture materials required much discouraging experimentation. Operating time had to be reduced to a minimum to keep within the physical endurance of patients who had no anaesthesia to relieve the pain of their operations. The fact that all of these handicaps were overcome is a great tribute to the ability of pioneer surgeons who not only developed ways and means to cure a high percentage of genital fistulas but who also, in the pursuit of their objectives, laid the foundations of modern gynaecology.

The causes for fistulous openings between the bladder and vagina are well known. In the early days of gynaecology about 85 per cent were due to tissue necrosis and infections which resulted from poor obstetric care and pressure of the foetal head in the course of prolonged labour. Very few were caused by trauma from operative deliveries.

With gradual improvements in obstetric routines, especially in the past 25 to 30 years, the incidence of all serious birth injuries has been markedly reduced. Vesicovaginal fistula is now a rare complication on any well conducted maternity service.

Factors which have contributed to better obstetric results include an increasing percentage of deliveries in hospitals, precise methods for diagnosis of cephalopelvic disproportion, improvements in the conduct of labour, avoidance of unduly prolonged labours and traumatic vaginal deliveries, effective routines for prevention and treatment of infections, an increase in accepted indications for Caesarean section and marked improvement in the training and competence of medical attendants.

Approximately 60 per cent of the vesicovaginal fistulas which have come under treatment at the Woman's Hospital in the past 20 years have been due to surgical trauma or defective healing of surgical wounds.

The increased incidence of postoperative fistulas can be attributed to modern trends in treatment of various gynaecological conditions. Subtotal hysterectomy for benign uterine conditions is being rapidly replaced by complete abdominal or vaginal hysterectomy. The current wave of enthusiasm for treatment of malig-

* The John Shields Fairbairn Memorial Lecture delivered in the Royal College of Obstetricians and Gynaecologists on 15th July, 1952.

nant diseases of the pelvic organs by radical surgery has led to many serious injuries to the urinary tract. More extensive vaginal plastic procedures for repair of birth injuries to the anterior vaginal wall and urethra, and especially those for stress incontinence, have also been followed by a certain number of fistulas which, as a rule, involve the proximal end of the urethra or the vesical neck or both.

Indications for most of the extensive gynaecological operations in use at present appear to be sound. Many of the surgical accidents and unfortunate postoperative results occur because these procedures are undertaken by surgeons who do not have the ability, training and experience to make accurate diagnoses, to judge surgical indications or to cope with the technical risks of the more extensive operative procedures.

Tissue necrosis from advanced malignant neoplasms of the uterine cervix, alone or in combination with the effects of irradiation therapy used to treat such tumours, is responsible for about 12 per cent of the vesicovaginal fistulas which come under treatment. There is reason to hope that the incidence of these fistulas may be reduced by the current campaign for early detection of cancer and by improvements in modern irradiation techniques.

Historical records reveal little interest in treatment of vesicovaginal fistula until the first half of the 19th century. However, between 1800 and 1850, many eminent surgeons in Britain, on the Continent and in the United States made determined and almost desperate efforts to find ways and means by which this distressing condition could be relieved. Their operations resulted in a few cures and many failures.

Continued progress in the development of surgical techniques for closure of genital fistulas dates to about 1850. As stated by Kelly (1906), "It remained for Gustave Simon 1854, of Darmstadt, and for Sims 1852, Emmet 1855, and Bozeman 1856, in America to usher in a new era in the cure of genital fistulas and to lay the foundations of modern gynecology."

Contributions of other surgeons include:

(1) "Flap splitting" as recommended by Collis of Dublin in 1861, and between 1890 and 1891 by Martin, Trendelenburg, Sänger, Fritsch, and others (Stone, 1906).
(2) Free mobilization of the bladder and separate suturing of the bladder and vaginal walls as introduced by Mackenrodt in 1894 (quoted by Stone, 1906).
(3) Suprapubic extraperitoneal closure of vesicovaginal fistulas by Trendelenburg in 1881 (quoted by Kelly, 1906).
(4) Suprapubic transperitoneal operations for urinary fistulas by von Dittel in 1893 (quoted by Kelly, 1906).

Operative techniques in use at present for closure of urinary fistulas are the same as those devised by the pioneers in this field of surgery or are ones which incorporate principles regarded as essential in the original techniques. However, modern gynaecologists have made significant contributions to the management of these patients and have devised many refinements in technique.

It is now an accepted fact that success or failure in wound healing may depend nearly as much on the general physical status of a patient as upon the condition of tissues about the field of operation. Preparation of a patient for operation must include not only steps to eliminate urinary tract infections and to be certain that tissues about a fistula are free of inflammation but also any treatments needed to raise the general health of the patient to a good level. This may require rest, a high protein, high vitamin diet and treatment of anaemia by administration of iron, liver and blood transfusions.

The modern gynaecologist takes advantage of facilities for accurate localization of a fistula. The incidence of postoperative tissue necrosis and wound infections have been reduced by efficient methods of antisepsis, improvements in the quality of suture materials and prophylactic use of antibiotics. A more complete knowledge of the anatomy of the urethra, bladder and vagina, has made it possible to carry out dissections in natural planes of cleavage, thereby preserving the blood and nerve supply to layers of tissue used to close fistulas.

All the original surgical procedures for closure of vesicovaginal fistulas utilized variations of the same technique, that is, approxima-

tion of the denuded margins of a fistula with interrupted silk or metallic sutures. The J. Marion Sims technique, an example of this type of operation, produced a high percentage of cures and led to the conviction that vesicovaginal fistula was no longer incurable.

Sims's success can be attributed to the fact that he perfected and popularized a relatively simple technique. It included means to carry out steps which he regarded as essential. Exposure of the fistula was accomplished by placing the patient in a knee chest or lateral prone position and use of a speculum to retract the perineum. His denudations of the margins of a fistula were wide and included all scar tissue. Silver wire sutures, known to cause the least tissue reaction, were used to close the fistula. Placement of sutures was through the entire thickness of the vaginal and bladder walls but not the bladder mucosa. Postoperative bladder drainage was effected by a metallic catheter. Execution of the Sims technique was facilitated by the speculum, special instruments and a metallic catheter which he devised. It seems certain that much of his success was due to his fertile imagination and his outstanding ability and manual dexterity as a surgeon.

Failures by many eminent surgeons to cure vesicovaginal fistulas in the first half of the 19th century can probably be explained by the fact that their efforts were frequently concentrated on a single phase of the problem, such as experimentation with suture materials, rather than on development of a complete surgical routine. However, Gossett of London reported in 1834 on a procedure which he had used to close a vesicovaginal fistula. In every respect his technique appears to be the same as that devised 18 years later by Sims. Unfortunately Gossett's operation was presented and published as a case report. It seems probable that neither he nor the medical profession realized the importance of his contribution.

It was the author's good fortune to learn the Sims method from Dougal Bissell who was trained under Thomas Addis Emmet and became a master at plastic surgery. Using silver wire sutures and instruments which were exact duplicates of those devised by Sims and Emmet he carried out their techniques in a most meticulous fashion. On the whole his results were excellent. Some members of our staff still prefer and use this method.

Personal experience with the Sims technique has led to the conviction that it is best suited for closure of small to moderate sized urethral and bladder fistulas which are reasonably accessible and on relatively flat surfaces. It is a difficult technique to apply to a fistula which is located in the lateral sulcus of the vagina or to one which is close to the cervix. Other plastic procedures are also more suitable for fistulas which occur in the vaginal vault following complete hysterectomy or after treatment of malignant neoplasms of the cervix. It should never be used for a fistula which cannot be closed without undue tension on the surrounding tissues.

Our results indicate that wound healing following the Sims type of operation is not always as certain or as solid as that from other plastic procedures. In a few of our cases postoperative results were disappointing in that small areas, pin-hole in size, failed to heal. Some were due to primary failures in wound healing. Others did not make their appearance until three months or longer after operation. Some of these small fistulous openings closed spontaneously. Others required subsequent operations. These unfortunate results serve to indicate the narrow margin which exists always between success and failure in wound healing following the Sims type of procedure. Surgical failures may be due to very slight imperfections in surgical technique or attempts to close certain fistulas by the Sims type of operation when other procedures in use at present would be more suitable.

For closure of a vesicovaginal fistula many surgeons now prefer surgical techniques which involve separation of the vaginal wall from the margins of a fistula and closure of the vaginal wall and opening in the bladder with two or more layers of tissue. Techniques used for this purpose are referred to as " flap splitting " and free mobilization of the bladder.

" Flap splitting " was probably first recommended by Collis of Dublin in 1861. He advised that the mucous membrane of the vagina be detached from the margins of a fistula

and that the wall of the vagina be split into two layers of about equal thickness. One layer was left attached to the mucous membrane of the vagina and the other to the wall of the bladder. The wound was then closed in two layers.

In 1894, Mackenrodt recommended free mobilization of the bladder. This required more extensive dissection but permitted closure of a fistula with less tension on the surrounding tissues.

For all plastic operations involving the anterior vaginal wall, including those for closure of fistulas, members of our staff are now convinced that the vaginal wall should be separated from that of the bladder in the natural plane of cleavage. As a routine procedure, incisions to open the wall are extended through its entire thickness. Further dissection to develop flaps is carried out in a thin, almost bloodless, layer of loose areolar tissue which is always present between the walls of the vagina and bladder. The vaginal wall is frequently opened well away from the margins of a fistula to be certain that dissection is started in this natural plane of cleavage.

Histologic studies of the vaginal wall have shown it to be made up essentially of smooth muscle which is supplied by blood vessels and nerves distributed between its fibres. The vaginal wall cannot be split into layers without damage to its blood and nerve supply. For this reason we believe that solid wound healing is more likely to occur if flaps used to close a fistula are developed from the entire thickness of the vaginal wall.

Free mobilization of the bladder facilitates two important steps in technique by which wound healing is promoted. Small or large openings in a freely mobilized bladder wall can usually be closed with two or more rows of sutures without tension on the surrounding tissues. Sutures to close the vaginal wall can then be placed in a way which will eliminate dead space and displace the bladder sufficiently to prevent suture lines in the walls of the bladder and vagina from being superimposed.

In the future it seems possible that closure of fistulas with well-nourished flaps may replace techniques which, for their success, depend upon careful approximation of the denuded margins of a fistula.

In 1918, Rawls of our staff described his so-called "fascia lapping" technique for treatment of cystocele. This procedure, which was subsequently improved and simplified by Bissell (1918), was eventually found to be unnecessary for cure of cystocele. However, it has proved to be an efficient method for closure of difficult urethral and bladder fistulas.

By this procedure the anterior vaginal wall is opened in the midline and the bladder is freely mobilized, including the area at which the fistulous opening in the bladder is attached to the vaginal wall. Openings in the bladder and vaginal walls are carefully closed with chromic catgut. With Emmet denuding scissors the vaginal mucosa is then carefully removed from the right flap of the vaginal wall. With mattress sutures of catgut the denuded flap is then drawn and fixed well beneath the left flap. Wound closure is completed by fixing the left flap of the vaginal wall over the denuded area on the right flap. This placement of flaps, in the manner of closing a double-breasted coat, fixes a double layer of well-nourished tissue over the repaired fistulous opening in the bladder and again prevents suture lines from being superimposed. Experience has proved that this procedure provides a wide margin of security for wound healing. A Foley catheter may be used for bladder drainage but management of patients treated in this way is the same as for any vaginal plastic operation. They may be allowed out of bed early and will usually void spontaneously soon after the operation.

In our experience some urethral fistulas are difficult to cure. Many are located at or near the junction of the urethra and blader, and are often associated with some degree of damage to the urethral sphincter mechanism. This group of injuries must also include those which have resulted in partial or complete destruction of the urethra.

A simple urethral fistula can usually be closed by the Sims type of operation or by flaps developed about its margins. The Bissell procedure, described above, has also served well for closure of urethral fistulas and especially for those involving the proximal end of the urethra

and the vesical neck. Development of flaps about the urethra requires careful dissection because the vaginal wall in this area is thin and also because there is no natural plane of cleavage between the walls of the vagina and urethra. However, flaps can usually be developed which are adequate for closure of urethral fistulas by the Bissell lapping technique.

At best, it must be admitted that these patients present difficult problems. From their standpoint, closure of urethral fistulas accomplishes little if the mechanism for control of urination fails to function. Closure of fistulas involving the proximal half of the urethra and/or the vesical neck should always be accompanied by plication of tissues as recommended by Kelly and Dumm (1914), Kennedy (1937) and others for treatment of stress incontinence of urine. If these procedures fail to establish urinary continence, a surgeon must resort to one of the suprapubic procedures in use for their purpose. Fascial slings have been used with some success but dissections required for placement of a sling involve the risk of disrupting a successful result from closure of a urethral fistula. Other procedures which can be used without disturbing scars from closure of fistulas are a suprapubic urethrovesical suspension as recommended by Marshall, Marchetti, and Krantz (1949), or tightening of the vesical neck by mattress sutures on its anterior surface as described by Furniss (1925). Until we acquire exact knowledge as to how urination is controlled it seems unlikely that means can be devised to cure all of these patients.

For a patient who has partial or complete destruction of the urethra, it is usually necessary to resort to a plastic operation to fill in the defect or to construct a new urethra. For this purpose techniques described by Noble (1901) and Farrar (1923) have been used with success. These techniques utilize flaps developed from the anterior vaginal wall or labia minora. More than one operation may be required to repair such injuries. The most difficult problem in treating these patients is again to establish control of urination. The only means available for this purpose are the surgical procedures referred to above for treatment of stress incontinence.

Urinary fistulas which occur at or near the vault of the vagina constitute a considerable percentage of all the fistulas which come under treatment at present. As a rule they are due to surgical accidents or faulty wound healing following complete hysterectomy or tissue necrosis which has occurred following successful irradiation treatment of malignant cervical neoplasms.

Treatment of these fistulas involves certain technical problems. Exposure of the operative field may require a generous perineal incision. Wound healing may be disturbed by scar tissue and poor nutrition of the surrounding tissues as a result of healed infections or the effects of irradiation. Proximity of some of these fistulas to the ureters necessitates cautious tissue dissections and placement of sutures.

In our experience two surgical techniques have been successful in closing a high percentage of these fistulas. For some we have used the Bissell lapping technique described above. For the majority we have used an old technique recently popularized in the United States by Latzko (1942). By this procedure mucous membrane about a fistula is removed from the vaginal vault in a way which leaves a large transverse elliptical area of denudation, involving both the anterior and posterior vaginal walls. This denuded area including the fistulous opening is then closed with 3 or more rows of fine chromic catgut. The procedure has the effect of occluding the vault of the vagina. For fistulas which occur following irradiation therapy the denudation is extended farther forward on the vaginal wall in order to utilize tissues for the closure, which are better nourished. For the same reason we have occasionally left the mucosa in the vault undisturbed and used areas of denudation at a lower level in the vagina to be certain of using more normal tissues for the procedure.

On account of difficulties in exposing fistulas in the vaginal vault many urologists and some surgeons prefer the transvesical approach. However, more solid wound closure can probably be accomplished by proper utilization of tissues derived from the vaginal wall. Visualization of these fistulas can be facilitated at times by use of episiotomy or the

Schuckardt incision or by placing the patient in the Bozeman position. An experienced gynaecologist will rarely find it necessary to resort to the transvesical approach.

An occasional fistula between the bladder and uterus can sometimes be treated best by the transperitoneal route. The risk of serious infection of the peritoneal cavity from this procedure can now be prevented by improved surgical techniques and use of the antibiotics.

Time will not permit a discussion of the diagnosis and treatment of the usual and bizarre types of urinary fistulas which come under treatment or of the difficult problems presented by some patients who have two or more fistulas.

In conclusion it may be stated that:

(1) Development of postpartum vesicovaginal fistulas can be almost entirely prevented by competent management of obstetric patients and skilful use of accepted operative obstetric procedures.

(2) Postoperative fistulas are as a rule due to surgical accidents and defective wound healing. Their occurrence is rare following operations by competent surgeons.

(3) The incidence of fistulas following treatment of malignant tumours of the uterine cervix can be markedly reduced by early detection of such neoplasms and modern improvements in the techniques for irradiation therapy.

(4) Closure of vesicovaginal fistulas can be made more secure by flaps developed from the vaginal wall than by the most painstaking approximation of the denuded margins of a fistula.

(5) Solid healing of wounds following closure of vesicovaginal fistulas can be promoted by utilization of flaps made up of the entire thickness of the vaginal wall and by techniques which avoid superimposition of suture lines in the walls of the bladder and vagina.

(6) Relief of symptoms from a fistula which involves the urethra and/or vesical neck may require a combination of surgical techniques to close the fistula and to restore function of the mechanism for control of urination.

(7) There is probably no better test of the skill and competence of a gynaecologist than his ability to select and apply a surgical technique for successful closure of a vesicovaginal fistula.

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RES OBSTETRICA IN THE BIBLE*

BY

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Introduction

In any approach to a study of medicine in the Bible three facts of fundamental importance must be borne in mind. The first is that from the days of Abraham until the revolutionary teaching of Jesus of Nazareth—"God maketh his sun to rise on the evil and on the good and sendeth rain on the just and on the unjust" (Matthew v, 45)—material prosperity and physical welfare were regarded essentially as signs of God's favour and the reward of obedience to His law, just as adversity and sickness were accepted as divine visitations and the direct consequences of transgression. "If thou wilt diligently hearken to the voice of the Lord thy God . . . and keep all his statutes, I will put none of these diseases upon thee, which I have brought upon the Egyptians: for I am the Lord that healeth thee" (Exodus xv, 26). And by contrast: "If ye walk contrary unto me I will bring seven times more plagues upon you according to your sins . . . and upon them that are left alive of you I will send faintness into their hearts; the sound of a shaken leaf shall chase them, and they shall flee as fleeing from a sword; and they shall fall when none pursueth" (Leviticus xxvi, 36). Since God was the one source of life and health so He was the only healer and, at least until the end of Solomon's reign, there were no physicians among the Hebrews. The priesthood was the divine agent and the health of the community was its exclusive province and responsibility.

The second fact to remember is that the Mosaic laws of health were designed with the primary object of increasing the manpower and developing the health and vigour of the people against the hazards of a prolonged sojourn in the desert and in preparation for the conquest and occupation of the Promised Land. At the same time they had the object and the effect of inspiring and fostering an exclusively national or racial spirit.

The third point is that these health regulations, though secular in their application, were given the form of divine edicts to ensure their strict observance ; and it is because they were in the beginning and have continued down the centuries to be so completely integrated in their religion that to this day the Jews have retained their identity as a peculiar people, racially as distinct and exclusive as they were three thousand years ago.

Racialism

For both eugenic and ideological reasons a rigid isolationism in relation to neighbouring communities was prescribed. In particular, marriage or extra-marital associations with aliens was forbidden, the religious institutions of conquered peoples were suppressed and not seldom, as in the massacres of Jericho and of Ai, the wholesale extermination of the victims and even of their cattle was ordered. "And when the Lord thy God shall deliver them before thee," the injunction ran, "thou shalt smite them and utterly destroy them; thou shalt make no covenant with them nor show mercy unto them. Ye shall destroy their altars, break their images and cut down their groves. Neither shalt thou make marriages with them" (Deuteronomy vii, 2).

There were, it is true, some notable examples of marriage to aliens. Moses himself had married an Ethiopian woman. Ruth, the wife of Boaz, the ancestor of King David, was a Moabitess. Esther married Ahazeurus, King of Persia. For the most part, however, such alliances ended unhappily. Esau had two wives, both Hittite women, "which were a grief of mind" to his parents (Genesis xxvi, 34). Samson's union with the Philistine Delilah ended

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in tragedy. And in a dramatic passage the consequences are related of a monarch's philandering with "strange women". The earlier chapters of the 1st Book of Kings give an impressive description of the state of Israel after the wars of conquest were over. All their enemies had been vanquished. The nation was prosperous and at peace. King Solomon was the most powerful and at the same time the wealthiest and wisest ruler of his age. His personal prestige was unrivalled. His fame reached even to Ethiopia and, when the Queen of Sheba came to pay a state visit, we read that when she saw all his wealth and his power "there was no more spirit in her" and "behold," she said, "the half was not told me." All the divine promises to the patriarchs had been abundantly fulfilled. It was Israel's Augustan age. Then Chapter xi opens significantly with the word "But" and goes on "King Solomon loved many strange women . . . and they turned away his heart after other gods". Thereafter, with the nation increasingly idolatrous and decadent, the story is one of a dying millenium, fading in the twilight of the Babylonian captivity. As the promises had been fully kept, so equally was fulfilled the doom foretold should the chosen people turn aside from the faith of their fathers.

Menstruation

Those laws in the Mosaic code which deal with sex hygiene are of special interest to gynaecologists. Menstruation was regarded as an unclean issue, as was indeed any form of vaginal bleeding, and congress of the sexes was forbidden until seven days after any such bleeding had ceased (Leviticus xvi, 19). Until recent years it was generally believed that conception was most likely to occur immediately following menstruation, so that the fertility of the Jewish race remained for long an enigma, to be solved only when modern research on the physiology of reproduction was found to explain and justify ancient scriptural precept.

Carcinoma of Cervix

The comparative immunity of Jewish women to carcinoma of the cervix is well known. An investigation by the Mount Sinai Hospital, New York, of 80,000 orthodox Jewesses showed that the proportion of those suffering from uterine cancer was as 1 to 15 of non-Jewish women of corresponding social status. This relative freedom from cervical cancer is unlikely to be in any way due to circumcision of the male, as has been suggested, for in other races, Asiatic and African, where circumcision is universally practised, the incidence of this disease is apparently not diminished. The further suggestion has been made that the immunity of Jewesses to carcinoma may be related to their sex hygiene and due to the absence of frictional trauma during the immediate post-menstrual period when the vaginal secretions are alkaline and the tissues less resistant to irritation and infection. This theory likewise impresses one as unconvincing, and meantime it seems best simply to regard the rarity of this form of cancer as an unexplainable racial peculiarity.

Venereal Disease

Venereal disease in the form of gonorrhoea and possibly of syphilis, if not common at the time of the exodus from Egypt, appears to have been sufficiently prevalent to justify efforts to control its spread. And the fear of contracting venereal infection from them may have been one of the reasons for the brutal massacres of conquered peoples and may have prompted such instructions as these: "Now therefore kill every male among the little ones, and kill every woman that hath known man by lying with him" (Numbers xxxi, 17). There are numerous references in the Bible to harlotry and brothels. In the seventh chapter of Proverbs, which is entirely concerned with prostitution, Solomon, illustrating the adage that a man begins to give good advice when he is no longer capable of setting a bad example, gives well-informed counsel to a young man on the enticements of the strumpet and warns of the physical as well as the moral dangers of lustful indulgence.

Despite the tradition that syphilis was brought to Europe by the sailors of Columbus, who had acquired it in the West Indies, numerous references suggest the possibility of its existence in the Old Testament era. Leprosy, from its description in Leviticus, was certainly a generic term used to cover a variety of conditions which may have included both syphilis and tuberculosis. What disease other than syphilis visits the

iniquity of the fathers upon the children to the third and fourth generation? (Exodus xxx, 5). The plague of Baal-Peor, who was a phallic god (Numbers xxxi, 16), may have been syphilis, though the evidence is flimsy, and certain verses in Job and in the Psalms and in Proverbs (viz., v, 11, and vii, 23) have been interpreted as referring to syphilis. It should be stated, however, that examination of skeletal remains provides no evidence of syphilis having existed in the Old World prior to 1500.

Less ambiguous in meaning are the passages describing what almost certainly was gonorrhoea and giving the regulations to control its spread. "When a man has a burning issue out of his flesh, because of his issue he is unclean" (Leviticus xv, 2). "Every bed whereon he lieth shall be unclean and everything whereon he sitteth shall be unclean." And again, "When a man hath taken a wife and married her, and it come to pass that she find no favour in his eyes, because he hath found some uncleanness in her: let him write her a bill of divorcement" (Deuteronomy xxiv, 1). Then follow clear instructions in regard to quarantine and disinfection both of the man and of his consort and of their belongings.

Medico-Legal Topics

Many topics of medico-legal importance are referred to in the Old Testament and some of these are of gynaecological interest. "Tokens of virginity", consisting of the undergarments of the woman, were examined by the elders for evidence of hymeneal bleeding in cases in which the husband alleged that he had found that his bride was not a virgin (Deuteronomy xxii, 14). If his accusation was judged to be groundless he was fined 100 shekels of silver; if he proved his case the woman was put to death.

Traumatic abortion is referred to in the following passage: "If men strive, and hurt a woman with child so that her fruit depart from her, and yet no mischief follow, he shall be surely punished . . . and he shall pay as the judges determine", and the possibility that the woman might die in consequence of the abortion is implied in the verse which follows. "And if any mischief follow, then thou shalt give life for life, eye for eye, tooth for tooth, hand for hand, foot for foot" (Exodus xxi, 22–26).

The penalties for adultery and for rape were, with one curious exception, severe. The punishment for carnal union with a married woman or with an unmarried woman who was betrothed, the woman consenting, was that both guilty parties should be stoned to death. Criminal assault of a woman who was betrothed likewise carried the death penalty for the assailant but, and this is the exception, if the woman assaulted was a virgin and not betrothed the punishment was limited to the man being compelled to marry the damsel and pay her father 60 shekels of silver.

Several cases of rape are recorded in some detail. The first of these concerns Dinah, the daughter of Jacob, who was ravished by Shechem, a prince of the Hivites (Genesis xxxiv, 2). The sequel is interesting. Though he had used her ill and incurred the anger of the girl's father and brothers, Shechem loved Dinah and wanted to marry her. Her brothers answered his proposal "with guile" and promised their consent to the betrothal provided every male of the Hivites was circumcised. This condition was accepted and implemented. "And it came to pass," we read, "on the third day, when they were sore, that two of the sons of Jacob . . . took each man his sword and came upon the city boldly and slew all the males . . . and spoiled the city because they had defiled their sister."

Another account of a particularly brutal sexual assault is given in a passage which is noteworthy for its dramatic and macabre quality. The characters were a certain Levite and his concubine who in the course of a journey came at nightfall to the city of Gibeah and found lodging there. The narrative goes on to describe how "as they were making their hearts merry, behold, the men of the city, certain sons of Belial, beset the house round about and beat at the door and seized the man's concubine and knew her and abused her all the night until the morning. And when the day began to spring they let her go. Then came the woman in the dawning of the day, and fell down at the door of the house where her lord was, till it was light. And her lord rose up in the morning and opened the doors of the house and went out to go his way. And, behold, the woman his concubine

was fallen down at the door of the house, and her hands were upon the threshold. And he said to her, Up and let us be going. But none answered [for she was dead]. Then the man took her [body] up upon an ass . . . and gat him unto his place. And when he was come into his house, he took a knife and laid hold on his concubine and divided her, together with her bones, into twelve pieces, and sent her into all the coasts of Israel" (Judges xix, 22–29). In the event this tragedy was the occasion of a civil war in which, according to the record, 65,000 persons were slain.

A third case of rape, the offence being aggravated by incest, was that of Tamar, the daughter of King David and the sister of Absalom, who was ravished by her half-brother Amnon. And after he had betrayed her, we read that "Amnon hated her exceedingly; so that the hatred wherewith he hated her was greater than the love wherewith he had loved her. And he said unto her, Arise, be gone. Then he called his servant and said: Put now this woman out from me, and bolt the door after her" (Samuel ii, 13). The sequel to this incident was that two years later Absalom slew his half-brother to avenge his sister's honour.

Sexual perversion in all its forms and including ritual sex mutilation (Deuteronomy xxiii, 2; Isaiah i, 3) was widely practised by those communities whom the Israelites encountered in their march through the desert and after entering Canaan. Its prevalence was undoubtedly one of the reasons why any form of social contact with them was forbidden. The cities of Sodom and Gomorrah and Gibeah were particularly notorious in this respect, but long after Sodom and Gomorrah had been destroyed, vicious sexual practices persisted and receive frequent mention in the Old Testament text. In the New Testament the first chapter of Paul's letter to the Romans may be read as a grim footnote to Gibbon's graphic account of the extent to which sensuality and sexual excess of all kinds were prevalent in Rome in the first century A.D. It is significant that, as in the reign of King Solomon a thousand years earlier, moral dissolution was an early portent of the decline and fall of a great empire.

Fertility

In all primitive races, fertility, whether of family or soil or stockyard, is regarded as a blessing, and infertility a misfortune. When the waters subsided after the flood, God's instruction to Noah was: "be fruitful and multiply and replenish the earth" (Genesis ix, 1). Fertility was foremost among the blessings promised the Hebrews if they would keep the divine commandments. "If thou shalt hearken diligently unto the voice of the Lord thy God, to observe and to do all his commandments . . . he shall make thee plenteous in goods, in the fruit of thy body, and in the fruit of thy cattle, and in the fruit of thy ground" (Deuteronomy xxviii, 11). "There shall nothing cast their young or be barren in thy land" (Exodus xxiii, 26).

Rebekah, when she left her home to marry Isaac, took with her this benediction of her kinsfolk: "be thou the mother of thousands . . . and let thy seed possess the gate of those which hate them" (Genesis xxiv, 60). These good wishes were not fulfilled for Rebekah was relatively infertile, her only pregnancy ending in the birth of the twins Esau and Jacob. Isaac's deathbed blessing of Jacob contained the words "God Almighty bless thee and make thee fruitful and multiply thee that thou mayest be a company of peoples" (Genesis xxviii, 3). And in the Psalms we find such texts as: "He maketh the barren woman to keep house, and to be a joyful mother of children" (Psalms cxiii, 9), "children are an heritage of the Lord: and the fruit of the womb is his reward" (Psalms cxxvii, 3).

Infertility

As fertility was a primary aim in life and its achievement a sign of divine favour, so barrenness was a sorrow and a reproach. A well-known verse in Proverbs reads: "There are three things that are never satisfied, yea, four things say not It is enough: the grave; the barren womb; the earth that is parched; and the fire which sayeth not, It is enough" (Proverbs xxx, 15–16). It is not impossible that Shakespeare may have had this verse in mind when, in the last scene of *Romeo and Juliet*, Romeo refers to the burial vault of the Capulets as "this hungry church-

yard". Abraham had been promised that of him would be made a "great nation" but after many years his wife Sarah was still childless and in his despair he cried to God: "what wilt thou give me seeing I go childless?" For answer he was told, "Look now toward heaven, and tell the stars if thou be able to number them: so shall thy seed be." In turn Isaac, his son, "entreated the Lord for his wife because she was barren" (Genesis xxv, 21). Jacob's wife, Rachael, was also barren until after many years she conceived and gave birth to Joseph. It is interesting that these three patriarchs, the founders of the most prolific race in the world, should each in turn have had wives who were relatively infertile.

At the same time the barren woman incurred the contempt of her rivals and sometimes the disfavour of her husband, the latter possibly because her sterility might be thought to reflect on his virility, a point of view not unknown to-day. When Hagar, Sarah's handmaid, was with child by Abraham, "her mistress was despised in her eyes" (Genesis xvi, 4). Rachael likewise, who was barren, incurred the scorn of her fertile sister, Leah, and at the same time the displeasure of Jacob, her husband (Genesis xxx, 9). Hannah, the mother of Samuel, was childless "and her rival [her husband's other wife] provoked her sore" (I Samuel i, 6).

There are numerous instances in Scripture of infertility followed by elderly primiparity. Sarah conceived and gave birth to Isaac, her only child, many years after the menopause. Rebekah gave birth to the twins, Esau and Jacob, 19 years after marriage; it was her only pregnancy. Rachael, as we have seen, was relatively sterile and had only two children, Joseph and Benjamin, born many years after marriage. Hannah, the mother of Samuel; Manoah's wife, the mother of Samson; the Shunamite woman; and Elizabeth, the mother of John the Baptist, are further examples of elderly primiparity. In each case the child was born alive and, except in the case of Rachael, the mother made a good recovery. It is of interest, in passing, to note that in so many of these cases in which conception occurred after a long period of barrenness the child was destined for a career of distinction.

Rachael's sterility is of medical interest in that it is the only case of its kind in which any form of treatment, if it can be called such, is mentioned. We read that Reuben, son of her sister Leah, Jacob's other wife, went in the days of the wheat harvest and found mandrakes in the field which he brought to his mother Leah, and Jacob lay with Leah that night and she conceived. The inference from the text is that Rachael also partook of the mandrakes and later she conceived and bare a son. Mandrakes, or love apples, are mentioned on only one occasion in Scripture, in the Song of Solomon (Chronicles vii, 13). The plant is alleged to have possessed anti-spasmodic and aphrodisiac properties. Incidentally, it is mentioned in Shakespeare's *Othello* and *Antony and Cleopatra* as a hypnotic.

Prenatal Impressions

The story of Jacob contains an interesting illustration of the belief in prenatal impressions which was universal in the days of the patriarchs and which even to-day dies hard. After his 14 years of service with his father-in-law Laban, the time came for Jacob to return to his own country together with his wives and children and his entire movable estate. The bargain he struck with his employer was that as a parting gift he should receive all the speckled and ring-straked cattle in Laban's herd. And as the date of his departure was still some months ahead he devised a scheme whereby this gift should be worthy of his acceptance. When the herds came to the drinking troughs and mated Jacob selected the best of the animals and set up before them partially peeled rods of poplar and plane tree so that the young might show appropriate markings. In the event it proved a highly successful example of selective breeding. It is not surprising, however, that in a later verse we read: "and Jacob beheld the countenance of Laban and, behold, it was not toward him as before" (Genesis xxxi, 2).

Antenatal Care

It is interesting to find an occasional reference in the Bible to antenatal care. Before the birth of Samson, for example, his mother was enjoined by the angel "now therefore beware, I pray thee, and drink not wine nor strong drink, and eat not any unclean thing" (Judges xiii, 4).

There are also many references to embryology and to quickening and foetal movement (Job x, 8–9; Psalms, cxxxix, 13–14; Genesis xxiv, 22; Ecclesiastes, ii, 5; Isaiah xl, 11; and Luke ii, 41).

Miscarriage

Nowhere in Scripture is any complication of pregnancy mentioned or implied with the exception of miscarriage and premature labour. Reference has already been made to the medico-legal aspects of traumatic abortion, the inference from the text being that the law in this specific instance applied to an abortion which was not intentional but rather an accidental consequence of a woman being involved in a scuffle between two men. On the other hand, there are several references to a deliberate major assault on a woman advanced in pregnancy. Elisha, prophesying the doom of Israel, said to Hazael, King of Syria, " I know the evil that thou will do unto the children of Israel: their strongholds wilt thou set on fire and their young men wilt thou slay with the sword . . . and rip up their women with child " (II Kings viii, 12). And a little later we read of Menahem, one of many kings of Israel who seized the throne after assassinating his predecessor, capturing a city (II Kings xv, 16). " And all the women therein that were with child he ripped up." This phrase, used metaphorically, was not uncommonly in the mouths of the minor prophets (Hosea xiii, 16; Amos i, 13).

As among the blessings vouchsafed those who kept the law was the promise " there shall none cast their young ", so among the curses for disobedience was that of Hosea: " give them, O Lord: what wilt thou give? Give them a miscarrying womb and dry breasts " (Hosea ix, 14).

Premature Labour

It is possible that Rebekah's pregnancy threatened to terminate prematurely for " the children struggled within her, and she said, If it be so, why am I thus? " (Genesis xxv, 22). Her concern may have been due either to the fear of premature labour or to apprehension that the tumultuous movements portended intra-uterine death. It is probable that Rachael's second labour (Genesis xxv, 19) and that of the wife of Phinehas (I Samuel iv, 20), to both of which I shall refer later, were in each case premature as the result of physical or emotional trauma.

Job cursed the day he was born and said: " Let the day perish wherein I was born and the night in which it was said, there is a man child conceived." " Why died I not from the womb, or as an hidden untimely birth I had not been, as infants which never saw the light? " (Job iii, 3, 11, 16; see also Pslams lviii, 8, and Ecclesiastes vi, 3).

Intra-uterine Death

Intra-uterine death is referred to and maceration described in the passage in which Miriam, the sister of Moses, was afflicted by leprosy because she had expressed her disapproval of Moses marrying an Ethiopian woman. Aaron, her other brother, pleaded for her in the words: " let her not be as one dead, of whom the flesh is half consumed, when he cometh out of his mother's womb."

Jeremiah, like Job, cursed the day he was born, in the words: " cursed be the man who brought things to my father saying a man child is born unto thee, making him very glad. Because God slew me not from the womb, or that my mother might have been my grave, and her womb to be always great with me " (Jeremiah xx, 17).

Stillbirth and Neonatal Death

While there are several examples of sickness in children—for example, that of the only child of the Shunamnite woman, the child of Jeroboam, and the child of the widow woman with whom Elijah lodged—the Biblical record contains no case of stillbirth and only one of neonatal death. The child that died was that born to David and Bathsheba, the wife of Uriah the Hittite, the death having been foretold by Nathan the prophet, as a punishment for David's sin. " And the Lord struck the child and it was very sick. And it came to pass on the seventh day that the child died " (II Samuel xii, 15, 19). The cause of death is quite obscure.

Labour

There were no physicians in the days of the patriarchs, and not indeed till many centuries later, so that, as in all primitive peoples, the conduct of labour was in the hands of midwives.

The fecundity of the Hebrews at the time of their enslavement in Egypt was a matter of concern to Pharaoh and he instructed the midwives to destroy the male children at birth. The midwives, however, disobeyed Pharaoh and, when he took them to task, they offered the explanation that: " the Hebrew women . . . are lively and are delivered before the midwives come unto them. Therefore God dealt well with the midwives and he made them houses." This is perhaps the earliest reference in literature to a maternity home (Exodus i, 15, 21). This well-known story gains in interest and significance if we accept the comment of Jewish scholars that the midwives were not Hebrew but Egyptian women, as their names Shiprah and Puah suggest (*The Pentateuch and Haftorahs*, edited by J. H. Hertz, London, 1950, p. 208). If these midwives were indeed Egyptian their defiance of Pharaoh implied an even greater fortitude and their attitude to a subject people an even higher ethical standard than if they had been Hebrew.

In the above passage the birth stool is mentioned and there are occasional references to the child being born " on the knees " of the midwife, which suggests that the squatting position or kneeling between the thighs of the attendant was the usual posture in labour, as it still is among primitive peoples. There is no other reference in Scripture to the conduct of labour, but the attention given to the newborn child may be inferred from a verse in Ezekiel which reads " in the day thou wast born thy navel was not cut, neither wast thou washed in water to supple thee; thou wast not salted at all, nor swaddled at all " (Ezekiel xvi, 4).

Pain of Labour

The view that parturition is easier and less painful in primitive than in more highly civilized communities is open to question, and it is noteworthy that in the Bible the pain of labour implicit in the primal curse of Eve is referred to again and again as a measure and a symbol of the extreme of emotional and physical suffering. The following is a short selection of passages on this theme. " The enemies of the Lord," we read in Psalm xlviii, " were stricken with terror, trembling took hold of them and pain as of a woman in travail." Isaiah wrote: " my loins are filled with anguish . . . as the pangs of a woman in travail " (xx, 3), and again " like as a woman with child that draweth near the time of her delivery is in pain and crieth out in her pangs " (xxvi, 17). And there is a suggestion of pseudocysis or possibly of dystocia in the words " we have been with child, we have been in pain, we have as it were brought forth wind, we have not wrought any deliverance." In Jeremiah iv, 31, we read: " I have heard a voice as of a woman in travail, the anguish as of her that bringeth forth her first child that gaspeth for breath, saying, Woe is me now! " " Sudden destruction cometh upon them as travail upon a woman with child," St. Paul wrote, and he continues: " they shall in no wise escape ", as though to emphasize the inevitability which the simile implies (I Thessalonians v, 3). Lastly we have a verse by St. John which might have come more naturally from the pen of the physician St. Luke: " A woman when she is in travail hath sorrow, because her hour is come; but as soon as she is delivered of the child, she remembereth no more the anguish, for joy that a man is born into the world " (John xvi, 21).

Puerperium

That part of the Mosaic code, which comprises the laws of purification and disinfection, gives detailed instruction in regard to physical and ritualistic cleansing after childbirth (Leviticus xii). It may be summarized by saying that a woman who gave birth to a male child was unclean (and presumably segregated) for 40 days and in the case of a female child for 66 days. No satisfactory explanation of the difference has been offered by Biblical commentators. After the days of the purification were accomplished the mother brought the appropriate offerings to the sanctuary and thereby became ritually clean.

Lactation

Lactation is referred to first in the case of Sarah, the wife of Abraham, who it will be recalled conceived long after the menopause and who nevertheless successfully nursed her son Isaac (Genesis ii, 7–8). It was apparently not unusual, as with many primitive people, for lactation to be continued till the child was two or three years old. Samuel, for example, was weaned at this age (I Samuel i, 21–25). More-

over, the effect of lactation on conception was appreciated. Hosea's wife became pregnant after lactation had been discontinued with the object of conception (Hosea i, 7).

Complicated Labour

There are comparatively few specific references in Scripture to complicated or difficult labour. This is not surprising as the Hebrews were a vigorous healthy race in whom dystocia was probably uncommon. Moreover, only those labours of the comparatively few central characters in the narrative are described and then only when the birth was abnormal.

Inertia may be read into the words of King Hezekiah spoken on the eve of the Assyrian invasion: "This is a day of trouble and of rebuke for the children are come to the birth, and there is not strength to bring forth" (II Kings ixx, 3). It is possible that Rachael's second labour, which will be referred to presently, was complicated by inertia. There is a hint of rupture of the membranes in these words of Job: "who shut up the sea with doors, when it brake forth, as if it had issued out of the womb?" (Job xxxviii, 8), and of hydramnios or peritonitis in the passage: "if thou hast gone aside to another instead of thy husband . . . let the cursed waters enter into thy belly and may thy womb swell and thy thigh rot" (Numbers v, 20–22).

Twins

Twins are mentioned twice. In both instances it is implied that the plural birth was diagnosed beforehand and in both cases the second child lay transversely. The first case was that of Isaac's wife Rebekah who conceived 19 years after her marriage and was presumably an elderly primigravida. "And the Lord saith unto her, two nations are in thy womb and two manner of people shall be separated from thy bowels. And when her days to be delivered were fulfilled, behold, there were twins in her womb. And the first came out red, all over like a hairy garment, and they called his name Esau. And after that came his brother out, and his hand took hold of Esau's heel and his name was called Jacob" (Genesis xxv, 21). This might mean nothing more than that Jacob grasped his brother's foot after he was born and therefore that the presentation was not necessarily transverse, but there is an interesting reference to this birth in Hosea (xii, 3) where we read "in the womb he took his brother by the heel".

The other case of twins was that of Tamar (Genesis xxxviii, 27) who was incestuously with child by her father-in-law, the patriarch Judah. "And it came to pass in the time of her travail that, behold, twins were in her womb, and it came to pass that one put out his hand and the midwife took and bound upon his hand a scarlet thread, saying, This came out first. And it came to pass, as he drew back his hand that, behold, his brother came out and afterwards came out his brother that had the scarlet thread upon his hand." The case is of special interest in that it is, so far as I know, the only instance in all literature of twins in which such a sequence in the birth of the two children is recorded, together with spontaneous evolution of the second child. The tying of a scarlet thread round the wrist of the second child makes the narrative completely unequivocal and convincing.

Maternal Deaths

Two maternal deaths are recorded. The first is that of Rachael, Jacob's favourite wife. It will be recalled that she was relatively sterile, her first child Joseph having been born many years after her marriage. It was the birth of her second child, Benjamin, that cost her her life. The tragic story as we read it is brief and dramatic. Jacob and his camp were travelling fast by forced marches, and Rachael was great with child, "and they journeyed from Bethel . . . and Rachael travailed and she had hard labour. And it came to pass, when she was in hard labour that the midwife said unto her, Fear not, thou shalt have this son also. And as her soul was departing, for she died, she called his name Benoni, but his father called him Benjamin; and Rachael died and was buried in the way to Ephrath, which is Bethlehem" (Genesis xxxv, 16–19). The cause of death can only be conjectured. The midwife's reference to the sex of the child, made before it was born, implies that the presentation was probably a breech. There is a suggestion, too, in an earlier passage (Genesis xxxi, 35) that Rachael suffered from menorrhagia and it is possible that fibroid

tumours may have explained her sterility, her menstrual upset and in the end her difficult labour. Alternatively, she may have died from haemorrhage and exhaustion induced or aggravated by the fatigue of the journey.

The other case of complicated labour which ended fatally was that of the wife of Phinehas, the son of Eli, the high-priest of Israel. The Israelites were engaged in battle with the Philistines and were heavily defeated " and there ran a man of Benjamin out of the army [so the narrative goes], and came to Shiloh the same day with his clothes rent and with earth upon his head. And when he came, lo, Eli sat upon a seat by the wayside watching; for his heart trembled for the ark of God. And when the man came into the city and told it all the city cried out. And when Eli heard the noise of the crying he said, What meaneth the noise of this tumult? And the man came hastily and told Eli. Now Eli was ninety and eight years old, and his eyes were dim that he could not see. And the man said unto Eli, I am he that came out of the army, and he said, What is there done my son? And the messenger answered and said, Israel is fled before the Philistines, and there hath been a great slaughter among the people, and thy two sons also, Hophni and Phinehas, are dead, and the ark of God is taken. And it came to pass, when he made mention of the ark of God, that Eli fell from off the seat backward by the side of the gate and his neck brake and he died, for he was an old man and heavy, and he had judged Israel forty years. And his daughter-in-law, Phinehas' wife, was with child, near to be delivered. And when she heard the tidings that the ark of God was taken and that her father-in-law and her husband were dead, she bowed herself and travailed, for her pains came upon her. And about the time of her death the woman that stood by said unto her, Fear not, for thou hast born a son. But she answered not neither did she regard it. And she named the child Ichabod saying, The glory is departed from Israel, because the ark of God was taken and because of her father-in-law and her husband." Again the cause of death is uncertain. Profound emotional shock or a massive postpartum haemorrhage following on precipitate labour seem the likeliest possibilities.

The whole dramatic story is told in ten short verses (I Samuel iv, 12–22). I have quoted it in full as an example of the impressive vigour and directness and austerity of language which distinguish the Biblical narrative throughout.

New Testament

That is really all I have to say but if you will indulge me for a further few minutes I want by way of epilogue and very briefly to refer to the New Testament. It does not, it is true, contain much of obstetrical or gynaecological interest. Indeed the only incident of this kind is that of the woman with the " issue of blood " recorded in each of the first three gospels; but any study of this kind, even if restricted in scope within the confines of one specialty, would be incomplete, or so I feel, that did not take account of the writings of one who was a member of our profession and whose Hellenic culture and scholarship graced and illumined every page he wrote and are manifest in every detail we have of his life and work. I allude, of course, to St. Luke, the author of the third gospel and of the Acts of the Apostles, and the first of a long line of physicians who are better known as distinguished men of letters.

St. Luke was a scholarly product of the Greek school of medicine and is for ever the prototype and exemplar of the good doctor who at the same time is a cultured gentleman. Of all the writers of the New Testament he alone was of non-Jewish origin. As might be expected from his cultural and scientific background his gospel differs in many respects from the others. In his alone do we find those magnificent canticles, the Magnificat, the Benedictus, the Gloria in Excelsis, and the Nunc Dimittis, though when we delight in their literary perfection let us remember too the debt we owe to the genius of the translators. Luke alone has preserved for us the two greatest of our Lord's parables, those of the Prodigal Son and the Good Samaritan, as well as those of Dives and Lazarus and of the Pharisee and the Publican. It is only in his account of the Crucifixion that we read of the Penitent Thief.

Both in this gospel and in the Acts his Hippocratic training is repeatedly betrayed by a medical phrase or by such presentation of detail

as is lacking elsewhere. The difference is seen in his circumstantial record of the Virgin birth and in his precise accounts of the healing miracles of our Lord, for example that of the woman which had a " spirit of infirmity ", that of the fever of Peter's wife's mother and that of the healing of the ear of Malchus on the night of Christ's betrayal. In his record of the woman with the issue of blood the implied reproach on our profession is softened by the omission of the words " had suffered many things at the hands of many physicians."

Reference to the Greek text makes clear the extent to which Luke used technical medical terms which do not appear in the other gospels. One instance only need be given, that of Luke's description of our Lord's passion in Gethsemane. Luke alone uses the word " agony " which in Greek medical terminology implies not merely intense pain but rather the last extremity of physical and emotional anguish.

A feature of Luke's character and writing and one of special interest to gynaecologists is, as Blair has pointed out, his attitude to women (*The Beginning of Wisdom*, by D. M. Blair, The Inter-varsity Fellowship, London, 1945). Luke's behaviour towards women was at all times one of chivalry and courtesy and tender consideration, in sharp contrast to the harsh and domineering possessiveness which for all time had characterized the behaviour of the Easterner towards his womenfolk.

As we wander through the great portrait gallery of the Bible we pause instinctively before the picture of St. Luke, and in his features we are aware of those qualities of kindliness and gentleness and humility and of that essential nobility of character implicit in the title of " Beloved Physician " bestowed on him by St. Paul. Read Luke's gospel again. There you will find, in Marlowe's phrase, " Infinite riches in a little room ". There too you will find the answer to the eternal question " who is my neighbour? " and in that answer you will discover the sure foundation on which each of us may build his own *religio medici*.

THE CAUSES AND PREVENTION OF STILLBIRTHS AND FIRST WEEK DEATHS

Part II: Evidence from Aberdeen Clinical Records

BY

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IN a previous paper (Duncan, Baird, and Thomson, 1952) "obstetric deaths" were defined as stillbirths plus deaths occurring during the first week of life. The conclusion drawn from an examination of national and regional vital statistics was that the great fall in the obstetric death rates which occurred between 1936 and 1944 was due more to improvements in social conditions and diet during pregnancy than to improvements in the standard of obstetric practice or to new scientific discoveries. The amount of evidence obtainable from official statistics is, of course, limited not only by the errors inherent in certification and by the lack of detail on the death certificate, but also by the methods of publishing such statistics. More detail can be obtained by using figures gathered from clinical records in one locality, but it may not be representative of national experience, and the relative smallness of the population at risk increases the proportional effect of random error. Nevertheless, under favourable conditions and with suitable safeguards, such local figures can provide information unobtainable from a larger field, and may be used to illustrate principles which are generally applicable.

MATERNITY SERVICES IN ABERDEEN

The population of Aberdeen burgh was 182,714 at the 1951 census, and there are annually slightly over 3,000 births to mothers resident in the city. The arrangement of the maternity services is at present simple, and nearly three-quarters of the births occur in the Aberdeen Maternity Hospital. Other cases are nearly all delivered in one private maternity home, or in their own homes by a general practitioner and midwife under the Domiciliary Midwifery Scheme, and for the last few years it has been possible to obtain much detail about the labour and the baby in most of these cases.

Table I gives an analysis of Aberdeen births under each arrangement during 1949–51. The total of 9,718 births (live and still) collected from local records is within 0.5 per cent of the offi-

TABLE I

Number of births (live and still) from 1949 to 1951 to mothers resident in Aberdeen. Emergency transfers to hospital of nursing home and domiciliary scheme cases have been referred back to their category at booking. (Local records.)

	Primiparous		Multiparous		All parities	
	No.	Percentage of primiparous	No.	Percentage of multiparous	No.	Percentage of all parities
A.M.H. booked cases	2944	86.0	4228	67.2	7172	73.8
Nursing homes booked cases	301	8.8	565	9.0	866	8.9
Domiciliary midwifery scheme	136	4.0	1427	22.7	1563	16.1
Unbooked cases (emergency hospital admission)	42	1.2	75	1.2	117	1.2
All births	3423	100.0	6295	100.0	9718	100.0

cially registered number, 9,764. It will be seen that only 4 per cent of primiparae and 23 per cent of multiparae are Domiciliary Midwifery Scheme cases. The percentage rises from about 10 per cent of those having a 2nd pregnancy to 59 per cent of those having a 7th or later pregnancy.

During the war years and since, the hospital maternity service in Aberdeen has been steadily expanded and improved, and the proportion of mothers booking for hospital has doubled at the expense of domiciliary and private nursing home confinements. The hospital policy has always been to give preference to the "bad risks"—not only those cases referred because of some abnormality, but primiparae (especially "elderly" primiparae) and high multiparae (especially those with a bad history). In practice very few women who wish to have the confinement in hospital are turned away.

The birth order distribution, the age distribution among primiparae, and the social class distribution of legitimate live births in Scotland and in Aberdeen during the years 1949–50, have been compared, using figures kindly provided by the Registrar-General for Scotland. They show that in Aberdeen 6.5 per cent of the legitimate births were to women having a 5th or subsequent birth compared with 11.3 per cent in Scotland as a whole, and that 55.1 per cent of Aberdeen mothers having a first baby were aged under 25 compared with 51.7 per cent in Scotland. The social class distributions among the population of Aberdeen are fairly similar to those of Scotland as a whole. Fig. 6 of our previous paper (Duncan, Baird, and Thomson, 1952) showed that during the past decade the stillbirth rate in Aberdeen has been consistently lower than that for Scotland. This might be explained, at least in part, by the fact that in Aberdeen primiparae are younger and high multiparae fewer than in the country as a whole. In the inter-war years it was less affected than Dundee and Glasgow by the industrial depression and unemployment.

Trends in the stillbirth and infant mortality rates in Aberdeen

In a fairly small population there are considerable annual fluctuations in death rates which make it difficult to observe trends. When the stillbirth rates in Aberdeen are considered by groups of years, the results shown in Table II emerge.

The rate remained high until 1938–40, according to local records obtained from the Medical Officer of Health. (No official rates were published until 1939.) There was a rapid fall during the war years after 1940, a slight rise during the immediate post-war years, then a further sharp fall to an apparently stable rate around 21 during the last 3 years. This pattern is very similar to that described for England and Wales in a previous paper (Duncan, Baird, and Thomson, 1952). The fall in the stillbirth rate in Aberdeen has been a little greater than that in Scotland as a whole.

The same table shows the infant mortality in Aberdeen divided into three parts: 0–6 days, the remainder of the 1st month, and 1–11 months. In the years 1940 and 1941, the death rates in the 7–30-day and 1–11-month periods rose sharply due to more deaths from infection, after which they fell fairly steadily until 1951, interrupted only by a rise in 1947 due primarily to an epidemic of gastro-enteritis. Deaths during the first week of life rose from 26.9 in 1939 to 30.0 in 1942, fell fairly steadily to 14.5 in 1949, and then levelled out.

Causes of stillbirths and neonatal deaths

All stillbirths from 1939 to 1951 have been allocated to cause-groups after a study of clinical records undertaken by one obstetrician (D.B.), supplemented year by year by numerous interviews with midwives who dealt with non-hospital cases. The allocation to causes is thus likely to be more accurate and consistent than that given on death certificates. In the earlier clinical records (1939–45) autopsy records were frequently absent, as a relatively high proportion of births took place outside the hospital, but this handicap is probably not of great significance under the conditions stated, since in most cases the clinical facts of the case on which the cause of death was assessed were accurately known.

Full details of the system of classification by clinical cause of death will be published later. Meanwhile, the following outline will enable the

TABLE II

Stillbirth and infant mortality rates (broken down into first week, rest of first month, and 1 to 11 months) in Aberdeen. (Stillbirth rates prior to 1939 and the breakdown of infant mortality were calculated from local records. The latter may show minor discrepancies compared with official returns for infant mortality as a whole.)

Year	Stillbirth rate		Infant mortality			Total infant mortality
			0 to 6 days	Rest of 1st month	1 to 11 months	
1931	43.5		25.1	13.0	52.3	90.4
32	50.9		25.4	13.5	54.0	92.8
33	42.2		25.2	9.6	44.1	78.8
34	43.6	Av. 44.6	26.1	13.4	37.1	76.5
35	38.1		24.4	12.7	53.5	90.6
1936	48.7		25.3	7.2	37.7	70.2
37	44.8		25.1	9.6	37.7	72.4
38	39.9		27.3	5.7	38.6	71.6
39	35.9	Av. 38.4	26.9	7.4	25.2	59.5
1940	39.4		28.5	14.3	43.2	86.0
41	32.0		28.6	15.5	33.0	77.1
42	30.4	Av. 31.5	30.0	5.9	31.0	66.9
43	32.3		26.8	11.8	29.2	67.8
44	22.2	Av. 23.3	22.1	5.7	28.8	56.6
45	24.5		21.2	5.3	27.2	53.7
1946	29.7		18.3	6.1	17.5	41.9
47	25.3	Av. 27.1	17.5	8.0	37.4	62.9
48	26.5		17.8	1.7	13.9	33.4
49	18.7		14.5	2.1	14.5	31.1
1950	22.4	Av. 20.8	14.6	1.5	12.1	28.2
51	21.3		14.5	3.3	8.6	26.4

figures presented here to be interpreted. Stillbirths were allocated to 7 cause-groups.

(1) Mature, cause unknown. The baby weighed more than 5½ pounds (or, where no birth weight was given, the pregnancy had reached term), and there was no obvious clinical cause for the death.

(2) Premature, cause unknown. Where the baby weighed 5½ pounds or less, or where no birth weight was given, and labour started prematurely, and there was no apparent clinical cause for the prematurity.

(3) Birth trauma.

(4) Pre-eclamptic toxaemia (with or without accompanying antepartum haemorrhage).

(5) Foetal deformity.

(6) Haemorrhage. Death in cases of placenta praevia, or accidental haemorrhage, without accompanying pre-eclampsia.

(7) All other causes (e.g., general maternal disease, Rh factor).

Fig. 1 shows that from 1939–40 to 1944–45 there was a fall in all causes of stillbirth except foetal deformity. The decline in stillbirths of unknown origin (mature and premature) supports the view that the national war-time fall in stillbirths due to ill-defined causes was real and not due entirely to a transfer of deaths from ill-defined to specific causes as a result of improved certification. In the period 1946–48 deaths in the " mature, cause unknown " group rose in Aberdeen, but not in the " premature, cause unknown " group, a point which will be discussed later. Both rates were very low during 1949–51.

The stillbirth rate from birth trauma behaved not unlike that from " mature, cause unknown ", showing a marked fall between 1939 and 1945, a rise during 1946 to 1948, and then a steep fall. The parallelism demonstrated in Fig. 1 is significant and not unexpected, as the two causes of death are closely linked in aetiology and behaviour, as will be shown in a subsequent paper. Both occur almost exclusively amongst mature infants; both have their greatest effect among primigravidae and in high parity cases;

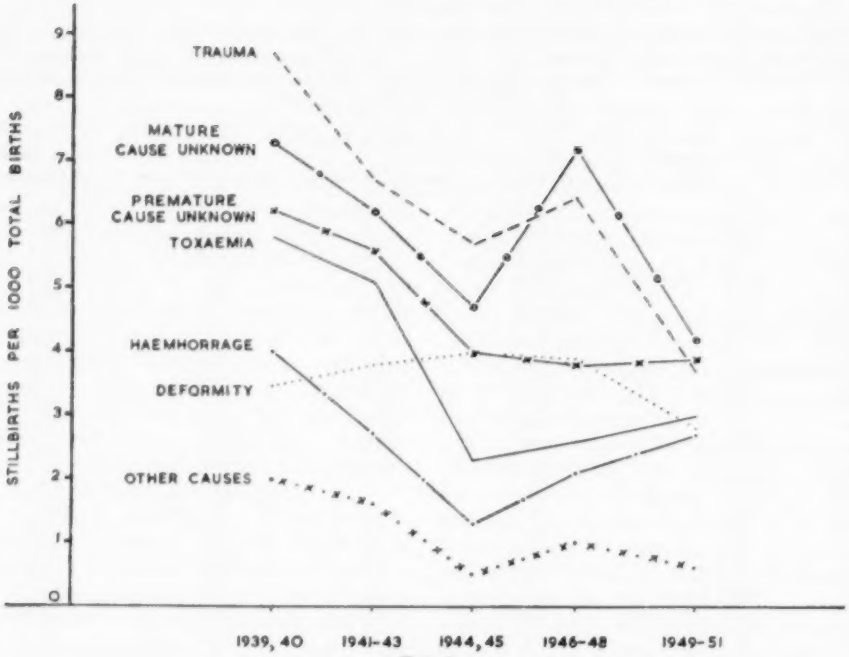

FIG. 1

Stillbirth rates in Aberdeen by clinical causes, 1939–51.
(Rates have been calculated for the periods 1939–40, 1941–43, 1944–45, 1946–48, and 1949–51: See Table II.)

both occur most commonly in pregnancy that is prolonged after the 40th week; both types of death can be greatly decreased by skilled obstetrical care.

Stillbirths from "prematurity, cause unknown" are, by contrast, very difficult to influence by skilled care. They arise from a breakdown in the physiology of pregnancy possibly dependent on the health and diet of the mother. In a previous paper, cited above, we have suggested that the improved economic conditions and the special rationing schemes for expectant mothers during the war did improve their health and nutrition and thus physiological efficiency, from which has followed the reduction in the number of stillbirths due to unexplained prematurity.

Fig. 2 shows first week deaths broken down into the following certified cause-groups: birth injury, atelectasis and "congenital debility", prematurity, and other causes excluding malformation which, for the sake of clarity, are excluded from the diagram. (Classification of first week deaths by clinical cause was not undertaken until recently.) There was a dramatic fall in 1944 in the death rate attributed to prematurity. The only other causes of death which fell during the war period were congenital debility and atelectasis. After the war, deaths from birth injury and other causes were at a lower level than formerly, and the death rate from prematurity continued to fall although the rate of improvement was slower than in 1944.

In summary, three facts stand out. Firstly, there was the striking fall in stillbirths from all causes except deformity and in first week deaths from prematurity and congenital debility and and atelectasis at the height of the war, in conformity with national experience. Secondly, there was a slight rise in the stillbirth rate due to

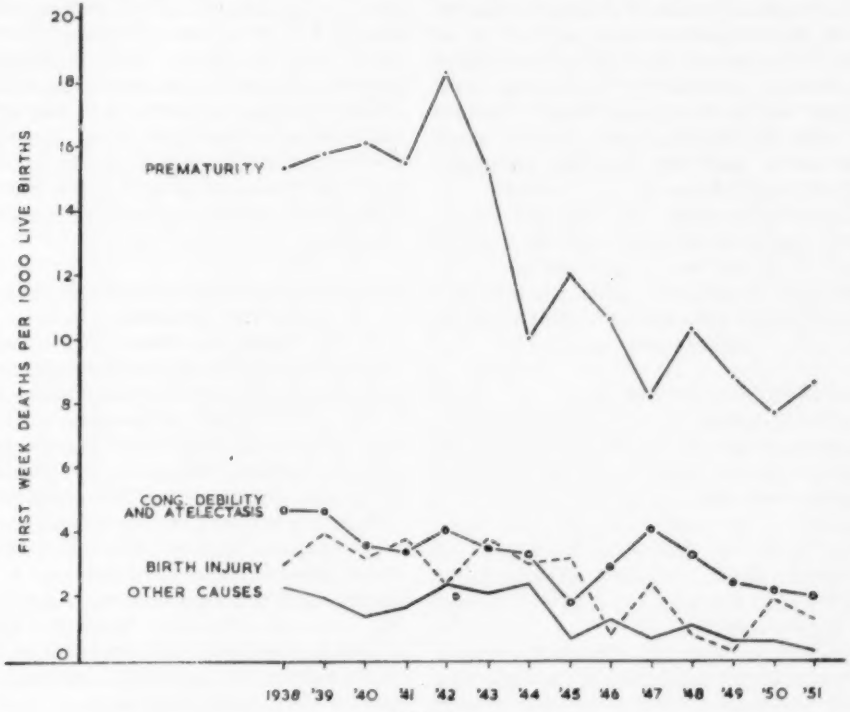

FIG. 2

First week death rates in Aberdeen by certified cause, 1938–51.

birth trauma and a much greater rise in that due to "mature, cause unknown" during 1946–47. Thirdly, stillbirths due to birth trauma and "mature, cause unknown" have both fallen sharply since 1948.

DISCUSSION

The probable causes of these trends are considered to be as follows:

(1) Improved health and nutrition of women during the war years, which continued during the post-war years.

(2) A great increase in the proportion of women confined in hospital.

(3) Improvements in the management of pregnancy and labour, and the improved care of babies.

(4) Fewer high parity births.

(5) A sudden rise in the birth rate during the immediate post-war years.

Improved health and nutrition of women

We have no data for Aberdeen which demonstrate this improvement directly, but it seems reasonable to infer that the reduction of stillbirths and neonatal deaths attributed to prematurity and lack of vitality which occurred both locally and nationally at the height of the war was due to full employment and an enlightened food policy. This hypothesis has been discussed in detail in a previous paper (Duncan, Baird, and Thomson, 1952). It is certainly difficult to believe that improved purchasing power, assured supplies of cheap nutritious foods for pregnant and nursing women, and intensive propaganda for better nutrition failed to have any beneficial effect.

Improved nutrition would be expected to lead to improved physiological efficiency, and notably to improved foetal growth and vitality. Fewer cases of unexplained prematurity, " congenital debility ", and similar conditions should therefore occur, and the stillbirth and neonatal death records show that this actually happened. Improved nutrition would also decrease the deaths from other causes. For example, infants of better vitality should withstand the stress of difficult labour with less danger from trauma or anoxia, hence improved nutrition may also have contributed to the reduction in deaths from birth trauma and " mature, cause unknown ".

Increase in hospital confinements

In 1939–40, about one-quarter of all births in Aberdeen were booked maternity hospital cases. The proportion rose to about one-half in 1946–47, and to about three-quarters in 1949–51. The increased use of hospital facilities was made possible mainly by increasing the number of beds, but the demand has been so great that in recent years the average lying-in period has had to be slightly reduced.

The war-time expansion of maternity beds in Aberdeen does not seem to have been part of a national expansion, but a local phenomenon. National figures for the war years are not available, but a personal communication from Dr. Douglas of the Department of Health for Scotland suggests that the war-time expansion of beds throughout the country as a whole was small, very much smaller than the doubling which took place in Aberdeen. The increase of hospital confinements meant that more women were under direct specialist supervision throughout pregnancy and labour. During antenatal care, blood-pressures were taken regularly, urine analyzed routinely, and women were weighed, so that pre-eclampsia was probably diagnosed more quickly and certainly than under domiciliary circumstances, and doubtful cases were quickly admitted to the antenatal ward. From 1941 a special nursery was available for premature or asphyxiated babies. Doubtless the provision of these facilities contributed to the fall in the death rate from toxaemia and anteparum haemorrhage, and also from prematurity. During labour, women in hospital are looked after by resident medical and nursing staff, and the attention of a consultant is available without delay when necessary. The availability of immediate skilled attention must have played a considerable part in the fall in stillbirths due to birth trauma. It should be noted that stillbirths due to birth trauma fell substantially in Aberdeen during the war years, whereas throughout Scotland as a whole the rate from this cause fell very little.

Improved management of labour in hospital and improved care of babies

During the period under review, increasing use has been made of Caesarean section in the interests of the child, a policy made possible by the greater safety of operative intervention due to the use of antibiotics. The avoidance of difficult vaginal deliveries, by the use of Caesarean section in suitable cases, not only reduces the incidence of birth trauma, it enables live babies to be delivered where otherwise foetal distress might have gone on to foetal death. Such measures have been used increasingly in the Aberdeen Maternity Hospital, especially since 1948, with considerable decrease in the number of infants lost from birth trauma and " mature, cause unknown ".

During this period also, special facilities for handling premature and weakly babies became available and are likely to have played a part in reducing the first-week death rate. The antibiotics had value apart from their role in Caesarean section, mentioned above. For example, maternal illnesses such as pneumonia could be cut short, thereby reducing the risk of intra-uterine death or premature labour. Again, the prophylactic use of antibiotics, during and immediately after difficult labour, reduces the chances of the child becoming infected. The reduction in obstetric death rates from the use of antibiotics in this way is difficult to estimate accurately, but is certainly small.

Fewer high parity births

In 1939–40, women having a 7th or later pregnancy contributed 15 per cent of the total stillbirths in Aberdeen. By 1944–45 this proportion had dropped to 7 per cent; in 1951 it was only 5 per cent. The parity distribution of

Aberdeen mothers during the war years is not known, but it is certain that the number of high parity births declined rapidly. In a previous paper (Duncan, Baird, and Thomson, 1952) it was shown that in Scotland as a whole the proportion of 7th or later legitimate births fell from 7.5 per cent in 1939 to 4.6 per cent in 1948. During 1949–50, in Aberdeen, only 1.9 per cent of legitimate births were 7th or later births, whereas in Scotland the proportion was 4.3 per cent. It is known that the national stillbirth rate among women of high parity did not fall much during the war years; if this was also true in Aberdeen (a point we are unable to check directly) the great decrease in high parity stillbirths in Aberdeen must have meant a reduction in the number of cases. The " natural " tendency towards limitation of families has been accelerated in Aberdeen by a policy of making contraceptive advice readily available to women who already have several children, and by offering sterilization (which is readily accepted) to anaemic and debilitated women who have large families and who are unable to use contraceptives effectively.

The principal causes of stillbirth in high parity cases are unexplained intra-uterine death, antepartum haemorrhage, and birth trauma due to malpresentation and cord prolapse. Such deaths are very difficult to prevent even in hospital, and more so in domiciliary practice. Most high parity stillbirths occur in Social Classes III, IV, and V, and many of the mothers are in poor general health, which contributes greatly to the high stillbirth rate. It is difficult to improve the nutritional status of such women, partly because their poor health has been of long standing, and partly because it is difficult to change their dietary habits, influence their mode of life, or even to persuade them to come into hospital during pregnancy for treatment. Many prefer to have the confinement at home where a sudden or unexpected emergency such as a prolapse of the cord cannot, in most instances, be treated quickly or effectively. While it is difficult to prevent loss of the baby from such a condition the chances are much better in a hospital which is well equipped and staffed. To obtain the best results, therefore, such women would have to be admitted to hospital some time before labour for rest, extra nourishment, and other treatment. The great decrease in foetal mortality from placenta praevia which has resulted from the conservative treatment of that condition (Macafee, 1945) shows what can be done by modern treatment in hospital for a condition which occurs relatively frequently among high multiparae. Despite the greatest care, however, the foetal mortality remains relatively high in women of high parity. As already stated, the number of births in these categories is falling steadily throughout the country and will probably continue to do so. In most cases, the pregnancies occur not because the mothers want so many children but because of ignorance of contraceptive methods. In recent years advice on family planning has been available much more freely at clinics, and is more often given by the family doctor. There are some who, because of rather low intelligence and education, or because of overcrowding and poor home circumstances, are unable to use contraceptives effectively. Such women are often debilitated and look much older than their years, and in these circumstances the risks of further childbearing are greatly increased. In such cases voluntary sterilization has, in the opinion of one of us (D.B.), a definite place.

The post-war rise in the birth rate

In Aberdeen the birth rate during each year from 1944 to 1948 was as follows: 16.5, 15.5, 20.4, 22.0, and 19.1. The increase of births beginning in 1946 took place mainly among 1st, 2nd and 3rd births and was due to the " accumulation " of marriages and pregnancies which had been postponed during the war. Thus, the average age of mothers rose, especially among primiparae. As the stillbirth rate rises with increasing maternal age, due largely to more " unexplained " stillbirths and to birth trauma following difficult or prolonged labour, a rise in the Aberdeen stillbirth rate during 1946 and 1947 was only to be expected.

Table III gives the best figures we have been able to extract in order to illustrate the changes which took place among primiparae and multiparae in the booked hospital, nursing home, and domiciliary groups. While these figures are accurate so far as they go, it is necessary to

TABLE III

Average annual numbers of cases and stillbirth rates dealt with under 3 types of maternity service in Aberdeen, before, during, and after the post-war rise in the birth rate. (Twin births excluded from all series. Booked hospital cases include a small proportion of "country" patients.)

	ALL PARITIES		PRIMIPARAE		MULTIPARAE	
Hospital booked cases	Average cases per annum	Average stillbirth rate	Average cases per annum	Average stillbirth rate	Average cases per annum	Average stillbirth rate
1943–45	1193	26.8	605	35.8	588	17.6
1946–47	2102	24.3	1030	25.2	1072	23.3
1948–50	2513	21.1	1061	24.8	1452	18.4
Nursing homes						
1943–45	No data		No data		No data	
1946–47	614	17.9	323	20.1	291	15.4
1948–50	342	18.5	142	16.4	200	20.0
Domiciliary scheme						
1941–45	557	27.3	106	24.6	451	27.9
1946–47	1126	31.1	258	32.9	868	30.5
1948	No data		No data		No data	
1949–50	521	22.1	52	28.8	469	21.3

point out certain limitations and inconsistencies lest an attempt be made to draw conclusions which cannot be fully justified. Our own conclusions — given below — are unavoidably tentative and rest as much on their general plausibility as on their mathematical basis.

The figures for booked hospital cases include a small proportion of "country" cases (most of whom are from the outer suburbs of the city, though outside the municipal boundary). This proportion (about 5 per cent) is small, and it appears to make little difference to the general pattern. The records for domiciliary cases during 1948 and for nursing home cases prior to 1946 are so incomplete that they have not been used in Table III. For 1946 and 1947, the nursing home and domiciliary records are not quite complete but do at least comprise the great bulk of cases occurring during these years, and there is no evidence that the missing cases are specially selected in any way which would affect the conclusions. Records for 1949 and 1950 are believed to be complete and accurate.

These limitations being understood, the figures in Table III may be discussed. In the first place, it will be observed that in 1946 and 1947 the average number both of hospital and domiciliary service cases was about double that in previous years. In the domiciliary service there were actually 2½ times as many primiparae annually as during 1941–45. These domiciliary primiparae contained more "elderly" primiparae and fewer young primiparae. Very similar age changes took place among booked hospital primiparae.

Among booked hospital cases, the stillbirth rate among primiparae fell from 35.8 in 1943–45 to 25.2 in 1946–47, and among multiparae rose from 17.6 to 23.3. In the domiciliary cases the rate among primiparae rose from 24.6 in 1941–45 to 32.9 in 1946–47, and among multiparae from 27.9 to 30.5. In other words, so far as primiparae were concerned, the increase in the number of hospital cases was accompanied by a substantial fall in the stillbirth rate. It is believed that this result was obtained by the provision of more beds and by increasing the staff, so that standards of care certainly did not deteriorate and probably improved. Among the domiciliary scheme cases, the strain of the suddenly increased numbers was not met so successfully, and in any event involved the delivery at home of many "bad risk" primiparae under conditions where the best facilities for conducting a difficult delivery were not available; therefore, the stillbirth rate rose. The number of multiparae also increased during 1946–47, and their average age rose, so that the risk of stillbirth was slightly increased among both hospital and domiciliary series. Since the

stillbirth rate among hospital primiparae fell, it is not easy to see why that among multiparae rose. It may be that, despite a policy to the contrary many "bad risk" multiparae were delivered at home before 1946. The rate among hospital multiparae was abnormally low during 1943–45 compared with Scotland as a whole. Again, the increased risks associated with rising age may not be so readily reduced by skilled treatment among multiparae, as compared with primiparae.

At all events, the fact seems to be that in the years of the high birth rate (1946 and 1947), a 30 per cent increase occurred in the stillbirth rate of primiparae delivered under the domiciliary scheme, and during the same years a considerable decrease took place among those primiparae delivered in hospital. This rise among domiciliary primigravidae, together with a rise among both hospital and domiciliary multigravidae, is sufficient to explain the rise in the over-all Aberdeen stillbirth rate during 1946–47. It will be noted that the stillbirth rates among nursing home cases during 1946–47 were considerably lower than among the other groups, but the proportion of cases confined in nursing homes was relatively small. Changes in the stillbirth experience of nursing home cases are, therefore, unlikely to have affected the all-Aberdeen picture significantly.

Our conclusion, therefore, is that the rise in the stillbirth rate for the city during 1946–47 was due partly to a change for the worse in the age distribution of cases, and partly to a failure to provide some cases, particularly primiparae, with the highest standard of obstetric care. It may be noted that there was no corresponding rise in the first-week death rate during 1946–47, merely a retardation of the previous fall. The rise in the stillbirth rate was due mainly to an increased number of deaths from "mature, cause unknown" and birth trauma, causes which have more effect on stillbirths than on first week deaths. Stillbirths from "prematurity, cause unknown" did not rise in 1946–47, and Fig. 2 shows that there was no great change in the first-week death rate from prematurity and other vague causes during these years. Analyses of local records show that, while the incidence of prematurity (birth weight 5½ pounds or less) is higher among primiparae than among multiparae, it is not very sensitive to maternal age, so that the changes which occurred in the age and parity composition of births would not have an important effect on the incidence of prematurity. Finally, a well-equipped premature nursery was available during the years in question and was able to deal with all infants, wherever born, about whose vitality there was any doubt. Taking all these circumstances together, it does not seem unreasonable that the stillbirth rate and the first-week death rate behaved somewhat differently during 1946–47.

Future Policy

It has been suggested (Baird, 1947) that stillbirth and neonatal death rates each of 10 per 1,000 are biological possibilities. While these rates may be utopian under present conditions, they should remain as targets. The stillbirth rate in Social Class I in Scotland in 1949 was 17 and the neonatal mortality was 14. Progress towards the targets will depend on public and professional policy in regard to three main factors:

(1) The maintenance of a high level of health and nutrition among women.
(2) The provision of the highest standard of care and attention in hospital for all "high risk" cases at least.
(3) Measures which will enable women who are not physically fit, or who are worn out by childbearing, to avoid further pregnancies.

Health and nutrition

The elimination of physical ill-health and "physiological inefficiency" among women is largely a matter of national economic and nutritional policy. Great advances were made as a result of the necessities of war, by the assurance of adequate purchasing power, by the provision of assured supplies of "protective" foods to children and to expectant and nursing mothers, and by intensive nutritional and health education on a national scale. The best results cannot be expected until every child has been conceived by a healthy mother and has been brought up under good physical, educational, and nutritional conditions. Current investiga-

tions in Aberdeen show that the poorest, least intelligent and worst educated social groups still live, in many cases, under poor physical conditions and continue to be relatively uninfluenced by health education. Present economic trends make it doubtful whether purchasing power and the availability of the appropriate foods will continue on as favourable a level as during the past decade. At least, further progress cannot be guaranteed automatically.

The nature and quality of the Maternity Service

There is considerable difference of opinion about whether childbirth should take place at home or in hospital. Those who advocate home confinement state that it has many psychological advantages, that it leads to more "natural" deliveries, and to better breast-feeding. Those who advocate hospital confinement state that most homes are not suitable for the safe conduct of even normal labour, that the mother cannot get the rest and attention she needs, and that if anything goes wrong there may be dangerous delay before remedies can be applied. No scientific analysis of the advantages and disadvantages of each system has been published, and indeed a comprehensive analysis would be difficult. Psychological factors, such as maternal preference, are dictated to a large extent by custom. If it is true that the average mother in Scotland has, in the past, been rather afraid of hospitals, it is also true that in America, where hospital delivery is customary, the suggestion of a domiciliary confinement might produce anxiety.

The problems of suitability of housing and of safety are more tangible. A recent analysis undertaken by Miss Barbara Thompson of cases booking for confinement in Aberdeen Maternity Hospital showed that 67 per cent of childless couples lived in one room, usually sub-let from the mother or mother-in-law. Of families with 3 or more children, only 10 per cent were living in sub-let rooms, the remainder having independent houses, but in 38 per cent of these there were more than 2 persons per room, counting the kitchen as a living-room. Also 12 per cent of all the cases who booked were living in houses with no private water supply. It is, therefore, clear that in Aberdeen at least a high proportion of houses are not suitable for the conduct of labour, or for the provision of adequate rest and nursing attention. It has been argued that when housing is improved then the drift towards hospital should and will be reversed, since with a good home labour can be safely and economically conducted. It should be noted, however, that the drift to hospital began before the war amongst the upper economic groups where housing conditions were satisfactory and where domestic help was still available in many cases. It is difficult to forecast the future, but it is probably worth while examining the present position to compare the relative safety of hospital and domiciliary midwifery. It is, however, difficult to get strictly comparable groups from which to assess the risks of hospital and domiciliary confinement, since nearly all primiparae are confined in hospital. Some multiparae who book for hospital confinement do so because of a bad obstetric history and, therefore, weight unfavourably the hospital cases. Some stay at home despite very unfavourable circumstances because they lack the necessary initiative to go to hospital or because they feel indispensable at home. Many of these women are not very intelligent and are not in good health and have a higher than average stillbirth rate, so that they weight the domiciliary sample unfavourably. A few women do not make any arrangements about the confinement, have no antenatal care, and usually call in a domiciliary midwife for the first time in an emergency after labour has started. Although the number of such cases is now small, they have a high stillbirth rate and neonatal mortality. For example, in the years 1949–51 there were 60 such cases in Aberdeen with 4 stillbirths and 1 neonatal death, an obstetric death rate of 83 per 1,000. Inclusion of such cases in the domiciliary group has an adverse effect on the over-all domiciliary figures.

Table IV gives the stillbirth and first-week death rates by parity for domiciliary scheme and booked hospital cases of legitimate single births in Aberdeen during the years 1949–51. It shows that practically all 1st births and about 90 per cent of 2nd births were delivered in institutions. The proportion of domiciliary cases in Aberdeen

TABLE IV

Stillbirth and first-week death rates among Aberdeen booked hospital and domiciliary scheme cases 1949–51, together with the proportion of cases in each parity delivered under the domiciliary scheme. (Legitimate maternities, single births.)

Pregnancy	Booked hospital cases			Domiciliary midwifery scheme cases			Percentage deliveries as domiciliary scheme cases
	Stillbirth rate	1st week death rate	Obstet. death rate	Stillbirth rate	1st week death rate	Obstet. death rate	
1st	22.2	16.1	38.3	34.5	17.2	51.7	3.8
2nd	14.9	8.9	23.8	24.6	3.5	28.2	10.1
3rd	16.7	11.1	27.8	10.3	5.2	15.5	23.9
4th–6th	16.8	15.4	32.3	20.9	5.2	26.2	42.7
7+	10.4	10.4	20.8	42.9	7.1	50.0	58.6

increased steadily with parity, until among 7th or later births 59 per cent were delivered under the domiciliary scheme.

The table also shows that cases booked for hospital had a lower stillbirth rate in all parities except the 3rd. The greatest difference is seen in primiparae and in multiparae having a 7th or subsequent child. In both groups the risk of stillbirth from birth trauma is high—in primiparae from long labour and in multiparae from malpresentation.

The following figures show that 7 out of 17 stillbirths (41 per cent) among domiciliary primiparae delivered in 1946–47 were due to trauma as compared with 7 out of 52 (13 per cent) among booked hospital primiparae.

It is reasonable to assume that hospital delivery would have prevented some of these cases of birth trauma.

On the other hand, in domiciliary practice the first-week death rate was lower at all parities except the first. There is no obvious explanation for this except that the selection of "bad risk" cases may have been fairly efficient and that those likely to have premature labours have been selected for delivery in hospital.

The figures given above make it difficult to avoid the conclusion that hospital confinement is preferable. If it is accepted that confinement in hospital is safer for certain types of patient, where the risks are high, it must also be safer for cases where the risks are less. There can be little doubt that if all women were confined in good maternity hospitals there would be fewer deaths. It is true that women having a 2nd, 3rd or 4th baby after a normal 1st delivery have relatively few complications and the risks are relatively small, yet the unexpected complication does occur and it is then usually treated more quickly and efficiently if the patient is in hospital. Nowadays, the standard of safety for mother and baby which is available in the best maternity hospitals is very high; most intelligent and educated mothers know this, and hence prefer to go to hospital, even when they have every reason to hope that confinement will be normal.

Age	No. of stillbirths		Stillbirth rate		Trauma All causes (per cent)
	Trauma	All causes	Trauma	All causes	
Booked hospital primiparae:					
15 to 24	3	23	2.4	18.6	13.0
25 and over	4	29	4.9	35.2	13.8
Domiciliary scheme primiparae:					
15 to 24	2	8	6.1	24.3	25.0
25 and over	5	9	26.7	48.1	55.6

TABLE V

Percentage distribution of social classes, by number of previous children. Aberdeen, 1949 and 1950 (Registrar-General for Scotland, provisional figures for legitimate maternities.)

Previous children	Social Class I	II	III	IV	V	All classes	Total No. all classes
0	4.9	11.2	55.8	15.8	12.3	100.0	2410
1	5.3	12.5	53.0	14.5	14.7	100.0	1937
2	3.5	11.1	51.7	16.9	16.8	100.0	1006
3	2.0	7.3	52.1	19.5	19.0	100.0	399
4+	3.7	5.3	45.2	19.2	29.6	100.0	416
All maternities	4.3	11.0	53.3	16.0	15.4	100.0	6168
Total maternities	265	676	3288	989	950	6168	—

The problem of the high parity births

It has already been shown that as a rule high parity cases have a high obstetric death rate. How far this is the inevitable effect of increasing multiparity or how far the result of the accompanying social factors is difficult to say. Table V shows that, although Social Class V produced only 15 per cent of all legitimate maternities in 1949–50 in Aberdeen, it produced 30 per cent of all those occurring in families where there were already 4 children. About half the large families in Aberdeen are in Social Classes IV and V. Many of the women were debilitated and lived in overcrowded houses, yet about half of them had the confinement at home. In such cases, labour often starts suddenly and progresses quickly with strong pains so that the baby may be born before the midwife arrives, or abnormalities, such as prolapse of the cord or transverse lie, may develop quickly. To obtain the best results such patients would have to be admitted to hospital before labour. Apart from other considerations, many are tired out and in poor health, so that the rest and good food would be very beneficial. Many do not wish to leave home and, even if they can be persuaded, the finding of accommodation for the children places a very considerable burden on the community. A further aspect of this problem, which is of more immediate concern to the general practitioner, paediatrician, and the Public Health Authority, is that the postnatal child mortality and morbidity are high in this group. Table VI shows the postnatal (1–11 months) death rates in Aberdeen by maternal age and parity for babies born in 1949 and 1950. Although the rates are based on small numbers of cases, they are in line with what an experienced clinician would expect, and also agree broadly with the findings of Burns (1942)

TABLE VI

Postnatal death rates (1 to 11 months) of infants born in 1949 and 1950 by age and parity of the mother.

Age of mother	Pregnancy number 1 P.N.D. rate	1 No. of deaths	2 P.N.D. rate	2 No. of deaths	3 P.N.D. rate	3 No. of deaths	4 P.N.D. rate	4 No. of deaths	5–7 P.N.D. rate	5–7 No. of deaths	8+ P.N.D. rate	8+ No. of deaths
15–19	14.7	5	—	0	—	0	—	0	—	0	—	0
20–24	4.6	5	13.7	8	20.8	5	60.6	4		—		0
25–29	15.0	9	10.5	8	18.5	8	15.4	4		—		0
30–34	—	0	5.5	2	10.3	3	6.8	1	24.1	4		
35+	—	0	9.4	2	5.7	1	13.8	2	24.1	6		
All ages	8.2	19	10.2	20	16.7	17	16.0	8	24.2	13		

in her survey of Durham County during 1930–37.

Postnatal mortality rises steadily from 8 among 1st children to 24 among 5th or later children. It is least in 1st, 2nd, and 3rd pregnancies when the mother is over 30 years of age, and highest when there are already 3 or more children, and the mother is young. In 1949–50, the proportion of women having a 5th or subsequent child was 6.7 per cent, but these women contributed 17.1 per cent of the postnatal deaths. One of the factors responsible for the low infant mortality in Aberdeen (26 in 1951) is the decrease in the number of large families. Experience shows that the current trend is to limit the size of the family to not more than 3 or 4. Families exceeding 4 are rare in the upper economic groups, and in the others the large family occurs more often because it cannot be prevented than because it is desired. It has been shown that the practical difficulties of lowering the obstetric death rate in high parity groups are great, and it is known that infant and child mortality and morbidity at all ages are above average in such families (Burns, 1942), although great improvements have been brought about by the antibiotics. A policy of family limitation where it is advisable or desired would improve the health and happiness of the mother and of the existing children.

Summary

(1) An analysis of clinical records and of statistical returns from the Public Health Department in the City of Aberdeen was undertaken in order to study trends in the stillbirth and first-week death rates, particularly since 1939. It was possible in this special study to ascertain the causes of death more uniformly and accurately than would have been possible by reliance on the death certificates. A new clinical classification of the causes of stillbirth was used.

(2) The stillbirth-rate fell sharply between 1942 and 1945, and this fall was distributed among all cause-groups except foetal deformity. The most striking falls were among stillbirths due to " unexplained prematurity ", pre-eclamptic toxaemia, and antepartum haemorrhage, but considerable falls also took place among deaths from birth trauma and " mature, cause unknown ". In first-week deaths, the main war-time fall took place among deaths attributed to prematurity, there being a fall in deaths due to " congenital debility and atelectasis " also, but not in deaths attributed to birth injury.

(3) The fact that a striking reduction in losses from prematurity and other ill-defined causes took place confirms the national findings from death certification, and supports the hypothesis that improved maternal health and nutrition was a major factor in producing the war-time trend. The sharp decline in stillbirths from birth trauma which took place in Aberdeen is unlike the national experience, and is attributed to the fact that during the war years hospital facilities were being rapidly expanded so that more patients came under specialists, supervision. No similar expansion of hospital facilities took place nationally.

(4) A reduction in the proportion of high multiparae—a group particularly liable to suffer stillbirth—contributed to the fall in the stillbirth rate, and was accelerated by a policy of making contraceptive advice readily available to those needing it, and by offering sterilization to women whose health had been seriously undermined by repeated childbearing. The child mortality in the period 1 to 11 months in Aberdeen is still 3 times higher in families of 5 or over than it is in a 1-child family, indicating a high wastage rate despite the efforts of the various health services.

(5) In the post-war years (1946–47) the stillbirth rate in Aberdeen rose, due to more deaths from birth trauma and " mature, cause unknown." This reversal of the war-time trend was associated with an increase in the number of births, especially 1st births, taking place at home, where the best facilities for the safe conduct of labour were not always available. Although the number of births in hospital also rose sharply during 1946–47, the stillbirth-rate among primiparae fell.

(6) Since 1948, the stillbirth rates from birth trauma and "mature, cause unknown " have fallen sharply and are now well below the levels in 1944–45. This is attributed to further extension of the facilities for hospital confinement and specialist supervision, and to the

increased use of Caesarean section in the interests of the child. Stillbirths due to pre-eclamptic toxaemia and antepartum haemorrhage have risen slightly since the war. First-week deaths due to prematurity have fallen slightly since the end of the war; the stillbirth rate from this cause has remained fairly steady.

(7) Future policy is discussed in the light of these findings, with special reference to the maintenance of a high standard of maternal health and nutrition, the nature and quality of the maternity service, and the problems presented by high parity births.

We are very grateful to the following people, who have helped us to obtain or have provided many of the statistics used in this paper: the Registrar-General for Scotland; the Medical Officer of Health, City of Aberdeen, and his staff; Dr. Charlotte Douglas, Department of Health for Scotland; Miss Barbara Thompson, research almoner with the Social Medicine Research Unit, Medical Research Council.

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A CASE OF UNIOVULAR QUADRUPLETS

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INTRODUCTION

QUADRUPLETS were born in Westminster Hospital on the night of 12th/13th September, 1950. Recent publicity suggests that cases of quadruplets are becoming more frequent but the natural incidence remains at approximately the cube of that of twin pregnancies, i.e., about 1:600,000 births. Further to this, uniovular quadruplets are extremely rare. There are now 4 surviving sets of "quads" in Britain; those associated now with the place names St. Neots, Bristol, Edmonton, and Westminster. Those of St. Neots and Edmonton are both 3 boys and a girl, those of Bristol and Westminster are both all girls. Of these 4 sets, however, the Westminster set is the only example of uniovular quadruplets.

It is realized that the danger of pre-eclampsia in twin pregnancies is about 4 times as great as in single pregnancies. Similarly premature onset of labour is more common quite apart from other obstetric complications. How much greater these dangers are with a quadruple pregnancy may well be appreciated. They largely explain why such a pregnancy is liable to early termination with failure of the infants to survive through prematurity and infection.

Should there be any difficulty in determining the date of the last menstrual period, then later in pregnancy the maturity of the foetuses can only be estimated by radiography.

DIAGNOSIS AND ANTENATAL CARE

Mrs. M. C., aged 27, first attended the Bessborough Street Maternity and Child Welfare Clinic on 25th April, 1950. In 1945 she had her first child, a boy, whose birth weight was 8½ pounds. The pregnancy had been normal, likewise the first and second stages of labour. The third stage was complicated by an adherent placenta necessitating a manual removal. Blood transfusion had not been necessary and the entire labour lasted 24 hours.

In 1946 bilateral pulmonary tuberculosis was diagnosed and the patient was treated by rest only in hospital for 5 months. Subsequent skiagrams had shown the condition to be quiescent.

Some confusion existed as to her last menstrual period. On 2nd February, 1950, she had had a 2-day loss, her last normal 4-day period being 5th January. On examination her general condition was good. She appeared to be a healthy-looking, well-nourished woman. No grossly abnormal physical signs were elicited in the respiratory, cardiovascular, or other systems. The uterus was enlarged to the size of a 16-weeks pregnancy. The estimated date of delivery was given as 9th November, but it was considered that this was erroneous and that 9th October was the correct approximate date of delivery. Her blood-pressure showed a systolic 125 mm. and diastolic 60 mm. of mercury, the urine was free from sugar and albumen, and her general condition satisfactory. X-ray of chest in March showed the pulmonary lesion to be quiescent.

Her pregnancy proceeded normally until the beginning of June when she exhibited some oedema of the ankles and hands. The blood-pressure and urine were normal, however, and she was advised to rest more. Weekly visits by the patient during this month showed an improvement in the condition. On 30th June

the blood-pressure was 120/80 mm.Hg, urine free from abnormal constituents, but the height of the fundus was larger than expected, being that of a 28-weeks pregnancy. A multiple pregnancy was considered and on 14th July, when the fundal height was that of a 32- to 34-weeks pregnancy and many foetal parts could be palpated, a skiagram was taken and "at least" 3 foetuses seen. The radiologist requested a further exposure and, on 4th August, the presence of quadruplets was confirmed (Fig. 1).

In view of the diagnosis and the oedema of the lower limbs, Mrs. M. C. was admitted to the Maternity Department of Westminster Hospital on 11th August. Her condition on admission was good; there was moderate oedema of the legs which subsided with rest in bed, the blood-pressure was 130/80 mm.Hg, and a non-catheter specimen of urine contained no sugar or albumen. Her girth measurement was 44½ inches.

Earlier, blood-tests showed her group to be O(IV), Rhesus positive, with no atypical antibody present, the Wassermann reaction and Kahn test being negative. The following is the outline only of investigations and suggested management of the pregnancy.

(A) MOTHER
- (1) Investigations.
  - (*a*) Chest.
    - (i) Full examination by physician.
    - (ii) X-ray.
  - (*b*) Blood tests.
    - (i) Haemoglobin.
    - (ii) Red blood cell count.
    - (iii) Serum proteins.
    - (iv) Blood urea.

(B) DIET
- (1) Salt restriction.
- (2) Extra protein (mainly in the form of dairy produce).
- (3) Vitamins. Halibut liver oil capsules; oranges, bananas and tomatoes; yeast tablets.
- (4) Iron. Fersolate tablets, 1 thrice daily.
- (5) Calcium. Ostocalcium tablets, 2 twice daily.
- (6) A bottle of stout daily.

(C) EXERCISES

To be allowed up for short periods only during the day. Physiotherapist to give massage and active exercises.

(D) WEEKLY

Weight.

(E) BI-WEEKLY

Girth measurements.

(F) DAILY

Blood-pressure charted.
Urine tested.
Progress notes, etc.

(G) MATURITY

X-ray at 36 weeks by dates.

(H) PREPARATION FOR DELIVERY AND CARE OF THE BABIES

(This will be described in some detail below.)

RESULTS OF INVESTIGATIONS (17th August 1950)

Haemoglobin	68 per cent	
Red blood cells	3,040,000	
Colour index	1.1	
Blood urea	6 mg. per cent	
Plasma proteins:		*Normal*
Albumen	3.26 g. per cent	4–5.5
Globulin	1.94 g. per cent	1.5–3.0
Fibrinogen	0.48 g. per cent	0.2–0.5
Total	5.68 per cent	6.0–8.0
Non-protein nitrogen	14 mg. per cent	20–40 mg. per cent

It was considered that the moderate degree of anaemia would respond satisfactorily to iron therapy alone.

At 12.15 a.m., on 12th September, the membranes ruptured. A skiagram was taken and this showed the first 3 foetuses to be vertices, with the fourth probably a breech. The following arrangements had been made to be put into operation immediately labour commenced:

(1) Streptomycin 0.5 g. twice daily and for 5 days after delivery. Also thioparamiozone 50 mg. daily following delivery.

(2) A labour ward bed to be transferred to a main theatre reserved for this occasion.

(3) Special incubators, by arrangement with Oxygenaire Ltd., to be installed in a prepared premature infant room.

(4) A full-time team of nurses, specially trained in the care of premature babies, standing by.

(5) Sterile cord ligatures in 4 different colours in separate sterile bottles (Allen & Hanbury); the colours to be used in definite order, this

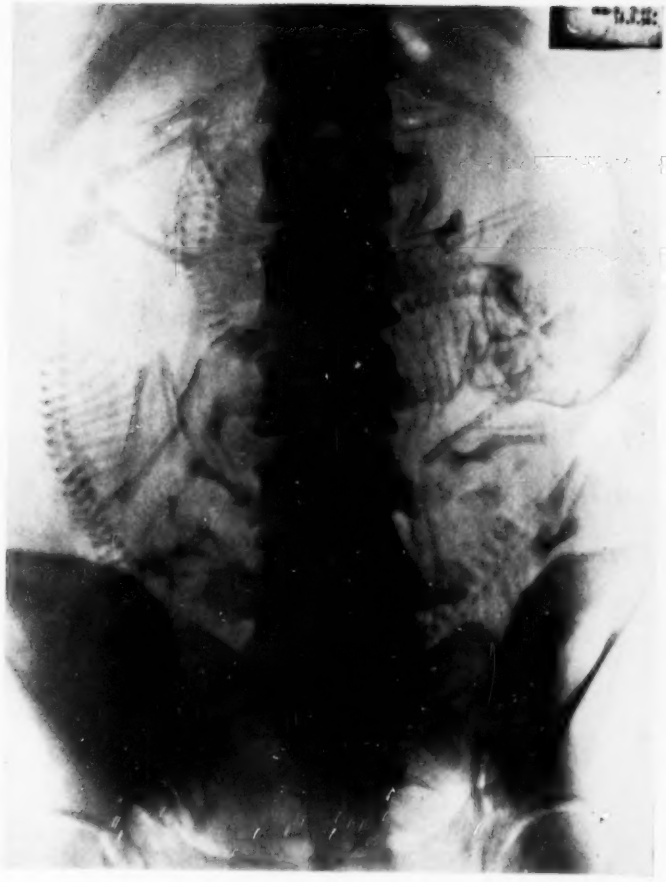


FIG. 1
Radiogram showing four foetuses

FIG. 2
The Placenta
Note insertion of only one cord into placenta, the others being velamentous.

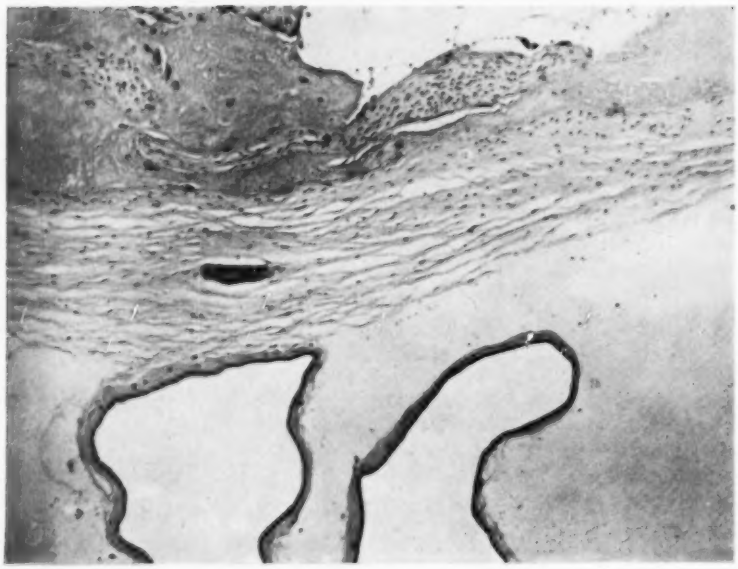


FIG. 3(A)
(Green/White)

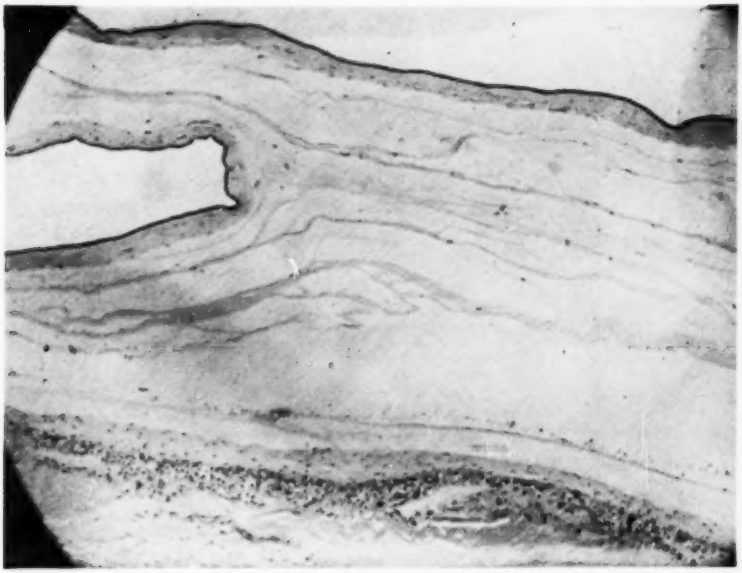


FIG. 3(B)
(White/Blue)

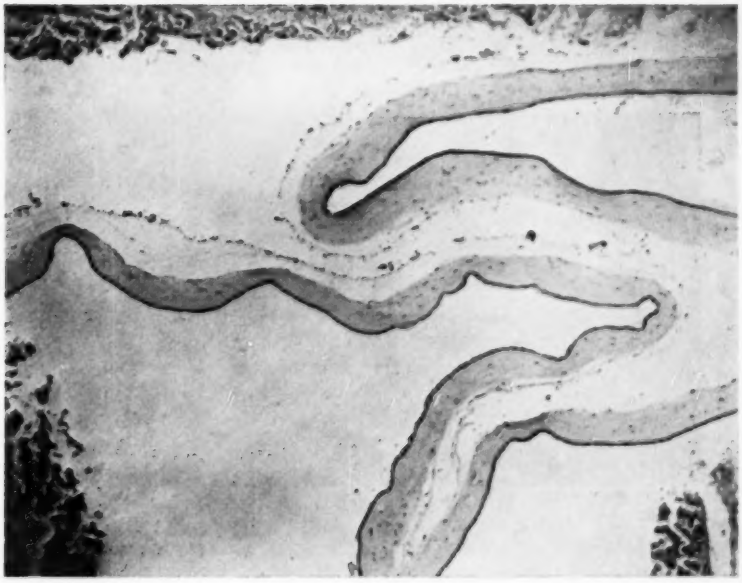


FIG. 3(C)
(Blue/Red)

Photomicrographs showing reflection of amniotic membranes off the common chorionic membrane covering foetal surface of placenta. It can be seen that the membranes are composed of two layers of amnion only.

FIG. 4
Aged 2 months

FIG. 5
Aged 5 months

(Figs. 4 and 5 reproduced by permission of *International News Photos*)

colour order being adhered to with the incubation, clothing, ribbons, etc.

(6) Portable Queen Charlotte type oxygen tents for conveying each infant from the theatre to the special incubator.

(7) Samples of blood to be taken from each cord as soon as the latter was divided.

(8) Paediatrician in attendance.

(9) Student dresser to make notes of progress, times, etc.

Labour and Delivery

At 8.45 p.m. on 12th September, 20 hours 30 minutes after spontaneous rupture of the membranes, labour commenced. Pains were fairly strong, occurring every 5 minutes. At 9.30 p.m. the patient was transferred to the theatre, prepared for the delivery. By 10 p.m. the pains were strong and every 3 minutes. On rectal examination, the first head was in the mid-cavity, the cervix fully dilated. The following notes will show the uncomplicated nature and rapidity of the labour:

12th September, 1950

11.00 p.m. Contractions fairly strong, slightly irregular. Foetal heart (No. 1) heard.

11.20 p.m. Cervix fully dilated. Patient encouraged to push in the lithotomy position and prepared for delivery.

11.25 p.m. Head seen at vulva—occipito-anterior.

11.34 p.m. 1st head crowned and delivered. Female infant born. Cried almost immediately. Cord tied with green ligature and divided between this ligature and a Spencer Wells forceps. Infant handed to Sister. The infant was placed in the portable oxygen tent and, as soon as its respirations were fully established, removed to the "prem" room and special incubator.

11.36 p.m. Specimen of cord blood taken.

11.37 p.m. 2nd vertex palpated abdominally. Found to be over the brim but not engaged. Foetal heart heard.

11.42 p.m. Contraction. Examination *per vaginam* carried out and head felt in mid-cavity. Membranes ruptured with Spencer Wells forceps.

11.47 p.m. Strong contractions. Head seen at vulva.

11.48 p.m. Head crowned. Female infant delivered (occipito-anterior). Cried well. Condition satisfactory. Cord tied with white ligature, and infant handed to Sister. Same procedure as with first baby carried out.

11.49 p.m. Sample of blood taken from second cord.

11.50 p.m. Presenting part palpable over brim. ? vertex, ? breech.

11.57 p.m. Fairly strong contractions. Show of blood. Patient encouraged to bear down.

13th September, 1950

12.01 a.m. Flow of liquor and a few clots expelled. Vaginal examination: vertex palpable. Membranes intact. Patient bearing down and co-operating well. Foetal hearts heard.

12.10 a.m. Intermittent contractions.

12.12 a.m. Two bulging sacs of membranes presenting—both ruptured with Spencer Wells forceps.

12.16 a.m. Vertex presenting at vulva.

12.17 a.m. 3rd head crowned and born "face-to-pubes". Female infant delivered. Condition satisfactory. Cried well. Cord tied with red ligature and same procedure as above followed.

12.19 a.m. Specimen of 3rd cord blood taken.

12.20 a.m. With good contractions the 4th head was seen at vulva. Crowned and born occipito-anterior. (Ergometrine 0.25 mg. given to mother intravenously at this point.) Female child delivered. Cried well after ligature and division of cord. Cord tied with blue ligature.

12.21 a.m. Cord blood sample taken.

12.24 a.m. Placenta expelled with 4 cords attached.

12.25 a.m. Uterus contracted down well. Blood loss normal. Further 0.25 mg. of ergometrine given intramuscularly. Mother's condition excellent.

12.35 a.m. Patient returned to ward. Temperature 98°F. Pulse rate 94. Respirations 20 per minute.

12.45 a.m. Omnopon gr. 1/3 (20 mg.) given subcutaneously.

Duration of Labour

First stage	2 hours 35 minutes
Second stage	2 hours 0 minutes
Third stage	— 3 minutes
Total	3 hours 38 minutes

Intervals between Births and Babies

Between 1st and 2nd	14 minutes
Between 2nd and 3rd	29 minutes
Between 3rd and 4th	3 minutes

The Puerperium

The mother made an uneventful recovery, involution proceeding normally. Lactation was inhibited with stilboestrol. On the 9th day of the puerperium, the patient's weight was 10 stones 12 pounds and girth measurement now 35¾ inches.

Skiagram of chest on 23rd September, 1950, showed no change from the previous exposure.

Management and Progress of the Infants

It is not within the scope of this article, nor does space permit, to give a detailed account of the feeding and general management of the infants.

From birth they came under the care of the Paediatric Department.

Their birth weights were 3 pounds 5 ounces, 3 pounds 15 ounces, 3 pounds 5 ounces, and 3 pounds 4 ounces, respectively.

The conditions of the 1st, 2nd, and 4th were satisfactory at birth and they cried well. The 3rd "quad" gave its first inspiration 15 to 20 seconds after birth, but respirations were feeble and grunting, with considerable recession of the lower ribs on inspiration.

The babies were nursed in Oxygenaire incubators with reduction of the oxygen supply on the 28th day, air supply only by the 35th day, and were transferred to ordinary cots on the 46th day.

With the exception of the first 24 hours, they were at first tube fed with increasing amounts up to 5 drachms of ¾-strength expressed breast-milk 3-hourly by the 8th day, full strength E.B.M. by the 14th day, and institution of bottle feeding on the 32nd day. On the 58th day, Cow and Gate half cream milk partly replaced the E.B.M.

Adexolin m. 2, and ascorbic acid 50 mg. were given on the 29th day, increasing the former to m. 4 on the 34th day and m. 12 by the 50th day. Mist. ferri. sulph., m. 20, was given on the 65th day, increasing to m. 50 by the 69th day.

The above, with very slight differences, was the feeding progress for all 4 infants.

The rib recession of the 3rd "quad" disappeared 48 hours after birth; "quad" 2 received a blood transfusion for anaemia (haemoglobin 51 per cent) on the 22nd day; whilst "quad" 1 developed persistent vomiting on the 9th day, necessitating the administration of subcutaneous saline and withholding of feeding by mouth for 12 hours.

The birth weights were regained on the 22nd day in the case of "quads" 2 and 4, "quad" 3 on the 25th day, and "quad" 1 on the 26th day.

When discharged on the 69th day their weights were:

"Quad" 1 . . . 6 pounds 11½ ounces.
"Quad" 2 . . . 7 pounds 14 ounces.
"Quad" 3 . . . 6 pounds 7½ ounces.
"Quad" 4 . . . 6 pounds 13½ ounces.

At this time the optic fundi of each appeared normal.

Follow-up at age of 1 Year

"Quad" 1. Has been walking, holding on, for 2 weeks. Weight: 19 pounds 10 ounces.

"Quad" 2. Has just commenced walking, holding on. Weight: 21 pounds 13½ ounces.

"Quad" 3. Crawls. Can stand supported. Weight: 20 pounds 11 ounces.

"Quad" 4. Walked holding on 6 weeks ago. She was the first of the 4 to do so. Weight: 19 pounds 8½ ounces.

Each has 2 teeth and can say "Mum" and "Dad".

The Placenta and Proof of Monovular Origin

On first inspecting the placenta it was seen to be a large, single structure with no obvious lines of fusion. The "white" cord was the only one to be inserted into the placenta itself, the other 3 being velamentous in type (Fig. 2). The membranes were very ragged and it was difficult to ascertain with any certainty whether or not the infants might be uniovular. In an endeavour to prove this, sections of the membranes were taken between the sacs close to the reflection from the foetal surface of the placenta. It was also considered that study of the blood groups of the family might give additional "proof". It might be mentioned here that the babies looked alike and this identical appearance has persisted. Sections were taken from the membranes dividing the sacs marked white, blue, red, and green, as seen in the placental diagram (Fig. 6). The amniotic reflections from the foetal surface of the placenta forming two layers of amnion only between sacs are clearly seen in the photomicrographs (Figs. 3a, 3b, 3c). The following report was received from the pathologist, Dr. A. D. Morgan:

Macroscopy

The specimen is a very large and thick placenta, 10 inches in diameter, 2 inches in thickness, and weighing 61 ounces (8.25 kilograms). Neither surface shows the slightest evidence of grooving or partition, the chorionic membrane covering the inner aspect in a smooth even layer.

The four umbilical cords are variously labelled white, blue, red, and green, in that order, reading in a clockwise direction with the inner aspect facing the observer. The "white" cord has a roughly central insertion, the other three velamentous insertions around the margin of the placenta. Corresponding to each is a thin-walled sac, apparently composed of one delicate membrane except on the outer aspect.

At the time the organ was first examined sections of the contiguous walls of the four sacs were taken for microscopic examination, i.e., white–blue, blue–red, red–green, and green–white (Fig. 6).

A set of histological preparations was taken: (1) from the wall of the outer sac at the junction of the *white and blue* sacs, i.e., including what appeared to be the contiguous margins of the white and blue amniotic sacs at the point of junction with the common chorionic membrane; (2) from the point of union of the *blue and red* amniotic sacs; (3) from the point of union of the *red and white* amniotic sacs; and (4) from the point of union of the *green and white* amniotic sacs, on their placental aspect. It was not possible during this examination to demonstrate a common membrane between the red and green sacs, owing to trauma at some stage. It was observed, however, that each sac peeled readily off the chorionic membrane covering the common placenta, revealing a smooth and undivided glistening layer, presumably a single common chorion.

Histology

The white and blue sacs composed of amnion only are seen coming off a common chorion; the blue and red sacs consist of amnion only; the red and white sacs consist of amnion only; and the white and green sacs, consisting also of amnion only, are seen coming off the common chorionic membrane which covers the placenta. Though it has not been possible to demonstrate the double layer of amnion between the green and red, it is quite clear that all four sacs consist of amnion only, the whole lot being contained by a single chorion and therefore associated with a common placenta, i.e. the quadruplets are uniovular.

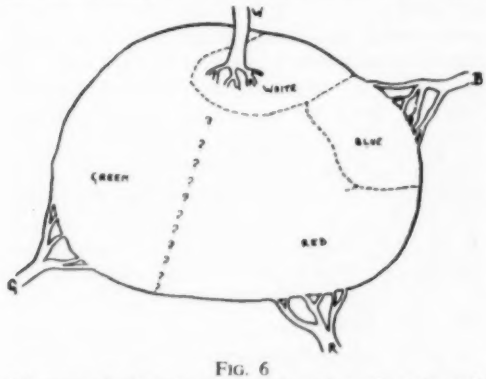


FIG. 6
Diagram of placenta showing insertion of cords and approximate reflection of membranes.

Preliminary blood-testing of the infants and their parents showed the following results:

	Group			
"Quad" 1	A	Rhesus	positive	R_1 R_3 CDe/cDE
"Quad" 2	A	,,	,,	R_1 R_3 CDe/cDE
"Quad" 3	A	,,	,,	R_1 R_3 CDe/cDE
"Quad" 4	A	,,	,,	R_1 R_3 CDe/cDE
Mr. C.	A	,,	,,	R_1 R_1 CDe/CDe
Mrs. C.	O	,,	,,	R_2 R_3 cDE/cDE
Master C.	A	,,	,,	R_1 R_3 CDe/cDE

Dr. Mourant of the Lister Institute has further studied the blood groups of these babies including the M.N. Lutheran, Lewis Kell groups, etc., and his results, we understand, are being published elsewhere. All these subgroups are identical in the 4 infants.

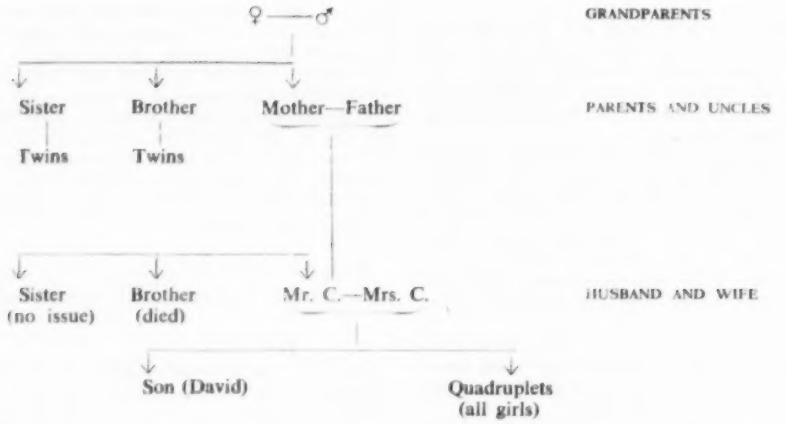
FAMILY HISTORY

While there was a history of twins in the family, this was not a strong one and only on the father's side. The genealogical tree on page 36 shows this.

DISCUSSION

There are two aspects of the case described which are interesting, unusual, and might even be described as remarkable. The first is the comparative freedom from complications, whilst the second lies in these 4 babies being uniovular. The methods employed in endeavouring to establish proof of the latter have been described and require no further elaboration at this point. Further consideration must, however, be given to the normal progress of this case.

In the first place the element of luck plays a major part in the successful outcome of the quadruple pregnancy. Early or late abortion, acute hydramnios in one or more of the



amniotic sacs, normal development and survival of 3 or fewer foetuses at the expense of their less fortunate companion or companions, congenital abnormalities, pre-eclampsia, particularly the likelihood and dangers of placenta praevia, malpresentations, premature rupture of membranes, etc., are to mention but some of the hazards that might well be encountered in pregnancy. Likewise, during labour the dangers of inertia, malpresentations, haemorrhage, third stage complications, etc., can be added to the list.

Bearing in mind this formidable list of possible complications, it is interesting to note how free from them this patient remained, even the 4 "final" presentations being by the vertex, and accompanied by an extremely "well behaved" uterus.

Nevertheless, even though the element of luck has been emphasized, it would be unfair to those concerned with the management of this case if the impression were created that luck and only luck was relied upon. Quite apart from prolonged rest and supervision as an inpatient, diet, ordinary precautions as well as the planning and preparations necessary for the delivery of the mother, her welfare and that of the infants, it must be stressed that the conduct of such a case is the work not of a single individual, but that of a team, or indeed a number of teams working in harmony and with a full realization of their particular responsibilities.

SUMMARY

A case of uniovular quadruplets is described.

(1) The diagnosis and antenatal care is described in some detail.

(2) The course of labour with details of each birth is set out in full note form.

(3) Particulars of the management of the babies is given.

(4) The method of proving their uniovular origin is discussed and illustrated.

We wish to thank all those who so ably contributed towards the care of this case. In particular, we would mention Sister Tomlinson and her team of nurses, Dr. Ian Anderson, Physician to the Children's Department of the Hospital, Messrs. Oxygenaire Ltd., for their advice and the loan of the special incubators. We wish also to acknowledge the help of Dr. F. D. Hart, the Departments of Medical Photography, Morbid Anatomy and Haematology at Westminister Hospital, and Dr. Mourant of the Lister Institute.

PREMATURE RUPTURE OF THE MEMBRANES

BY

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PREMATURE rupture of the membranes is defined for the present purpose as spontaneous rupture occurring before the recognizable onset of labour, and this communication deals with 1,052 patients in whom this complication was observed in the Obstetric Department of Southmead Hospital, Bristol, in the two years 1949–50.

The diagnosis, in each case, depended on clinical evidence, without recourse to chemical tests for the escape of liquor amnii. A small number of questionable cases had to be eliminated, but otherwise there was no selection of clinical material.

Incidence

Among 7,587 total admissions in the period under review, the incidence of premature rupture of the membranes was 13.9 per cent. The incidence rates for primigravidae and multigravidae were very similar—12.9 per cent in the former and a little higher, 14.7 per cent, in the latter—so it would seem that the occurrence of this complication is not greatly influenced by parity. The frequency of premature rupture of the membranes among "booked" cases was 13.7 per cent and among "emergency" cases 15.0 per cent.

Onset of Labour

Premature rupture of the membranes may be closely followed by the onset of labour. Indeed it may sometimes be difficult to determine which was the initial event, so that in a proportion of cases the two occurrences are recorded as having been simultaneous. This paper is not concerned with this class of case, but only with the case in which rupture of the membranes precedes the recognizable commencement of labour. Even so, not infrequently the onset of labour is recognized very soon after premature rupture of the membranes and in this investigation in 166 cases (15.8 per cent) labour supervened within the hour.

The latent period in the remaining cases varied widely. The longest interval recorded was 160 hours. In only 18.4 per cent of cases was the latent interval more than 48 hours, in 11.4 per cent it exceeded 72 hours, and in 7.4 per cent it was more than 96 hours.

Complications of Pregnancy

It would be purposeless to produce in detail all the tables made out in an attempt to correlate premature rupture of the membranes with various antenatal complications and the sequelae to mother and child which may follow.

It need only be said here that, in the present investigation, antenatal complications did not appear to be of any importance aetiologically. The commonest of such complications was pre-eclamptic toxaemia. Among 738 cases of toxaemia there were 116 instances of premature rupture of the membranes, an incidence of 15.7 per cent, to be compared with the general rate of 13.9 per cent.

Presentation of the Foetus

It is traditional teaching that a badly fitting presenting part is a potent aetiological factor in the production of premature rupture of the membranes. The results of this investigation lend ample support to this view for, though the figures in the case of face, brow and shoulder presentations are small, it is significant that in malpositions of the vertex, in the various malpresentations and in multiple pregnancy, too, the incidence of premature rupture of the membranes was very substantially higher than the general incidence rate of 13.9 per cent already quoted (Table I).

TABLE I

Presentation	Total cases	Premature rupture of membranes	Incidence per cent
Vertex, occipito-anterior	6133	775	12.6
Vertex, occipito-lateral	302	52	17.2
Vertex, occipito-posterior	610	110	18.0
Face	13	3	23.1
Brow	3	1	33.3
Breech	336	76	22.6
Shoulder	22	6	27.3
Multiple pregnancy	168	29	17.3

Prolonged Labour

The average duration of labour among the cases of premature rupture of the membranes was 17.5 hours in primigravidae and 8.7 hours in multigravidae. In a control group of 1,000 consecutive cases the average duration of labour was 17.3 hours in primigravidae and 9.0 hours in multigravidae—almost identical figures for the two groups.

The immediate presumption that—whatever the outcome for mother and child—a "dry labour" is not prolonged would be natural. However, closer examination of the matter is most revealing and shows that this concept is false.

Fig. 1 compares the frequency of labour lasting more than 24 hours among the total hospital cases and among the patients with premature rupture of the membranes.

It is seen that there is a noticeable but not a big increase in the incidence of prolonged labour following premature rupture of the membranes. More significant is the observation that the incidence of prolonged labour depends on the length of time the membranes have been ruptured before the onset of labour. In cases where the rupture of the membranes is quickly followed, within the hour, by the onset of labour, the incidence of prolonged labour is actually less than in the control group. When the membranes have been ruptured more than 1 hour the incidence is higher than in the control group.

Still more important, the frequency of prolonged labour increases progressively with the interval between rupture of the membranes and the onset of labour, so that when the membranes have been ruptured 24 hours the likelihood of prolongation is nearly 50 per cent increased, whilst when the membranes are ruptured 72 hours the frequency of prolonged labour is roughly doubled.

In Fig. 2 a more stringent criterion of prolonged labour is adopted and only labours lasting more than 48 hours are recorded. The figures show a remarkably similar trend to those of the previous table and indicate again that, whilst labour tends to be shorter in cases where the onset of labour follows quickly on rupture of the membranes, labour is prolonged when there is more than an hour's delay in its onset. Moreover, there is, again, a correlation between the latent period and the incidence of prolonged labour which is more than half as much again when the membranes have been ruptured 24 hours, and is doubled after 72 hours delay in the onset of labour.

Intervention

The forceps rate for cases of premature rupture of the membranes was 7.4 per cent. This is not high, nor is the hospital forceps rate of 6.1 per cent with which it is to be compared.

Thirty-two Caesarean sections were performed in cases with premature rupture of the membranes, giving an incidence of 3.1 per cent. The over-all hospital Caesarean section rate was 2.9 per cent.

These facts are contained in Table II which also shows the corresponding figures for cases in which the membranes ruptured more than 48 hours before labour began, together with the frequency of other forms of intervention.

Among the cases of premature rupture of the membranes these intervention rates are slightly higher than in the control group. The conclusion may therefore be drawn that, whilst the differ-

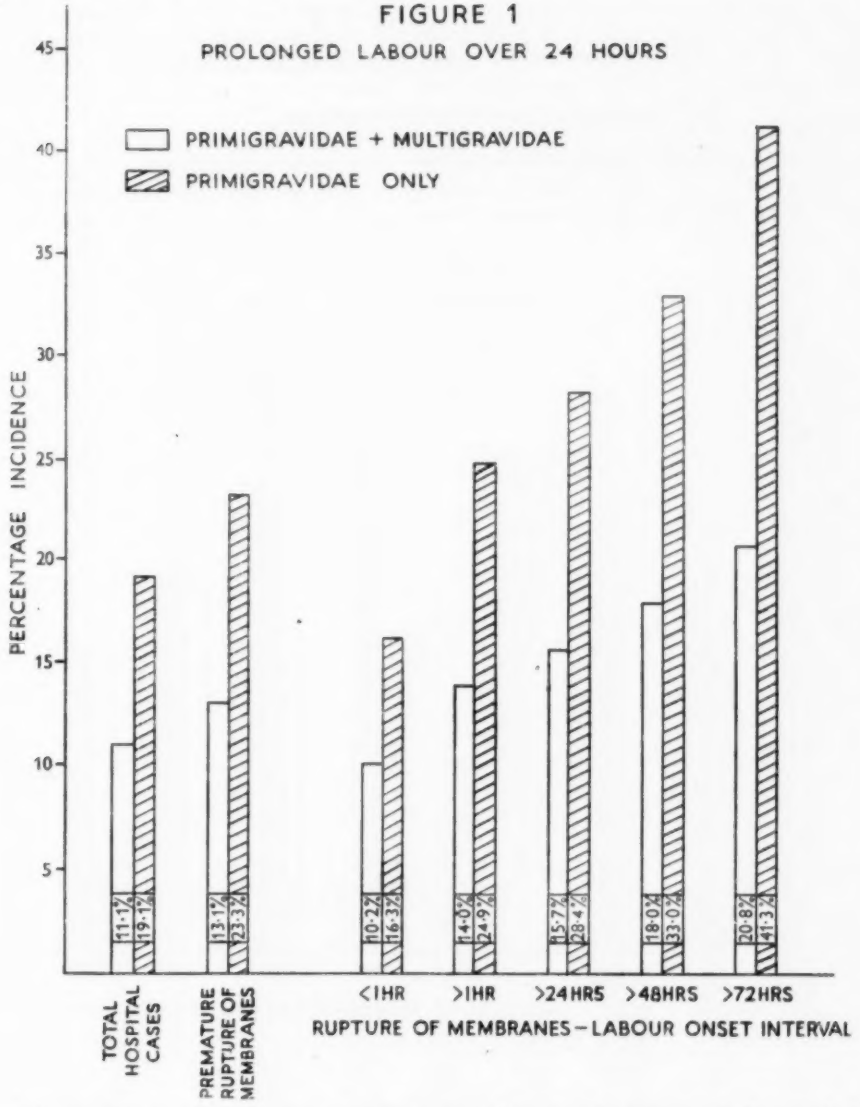
TABLE II

Intervention—Percentage Rates

	Hospital rate	Premature rupture of membranes	Premature rupture of membranes, >48 hours
Forceps	6.1	7.4	7.7
Caesarean section	2.9	3.1	3.6
Other	2.3	3.2	3.1

FIGURE 1

PROLONGED LABOUR OVER 24 HOURS



ences between the two groups are not very marked, premature rupture of the membranes does somewhat increase the need for surgical intervention.

Maternal Mortality and Morbidity

There was one maternal death in a patient whose membranes ruptured prematurely. Death was due to pulmonary embolism and delivery had been uneventful.

Table III gives the morbidity rates for cases of premature rupture of the membranes and for the control series. Both the "total morbidity" and "notifiable morbidity" are slightly increased in the premature rupture of mem-

FIGURE 2

PROLONGED LABOUR OVER 48 HOURS

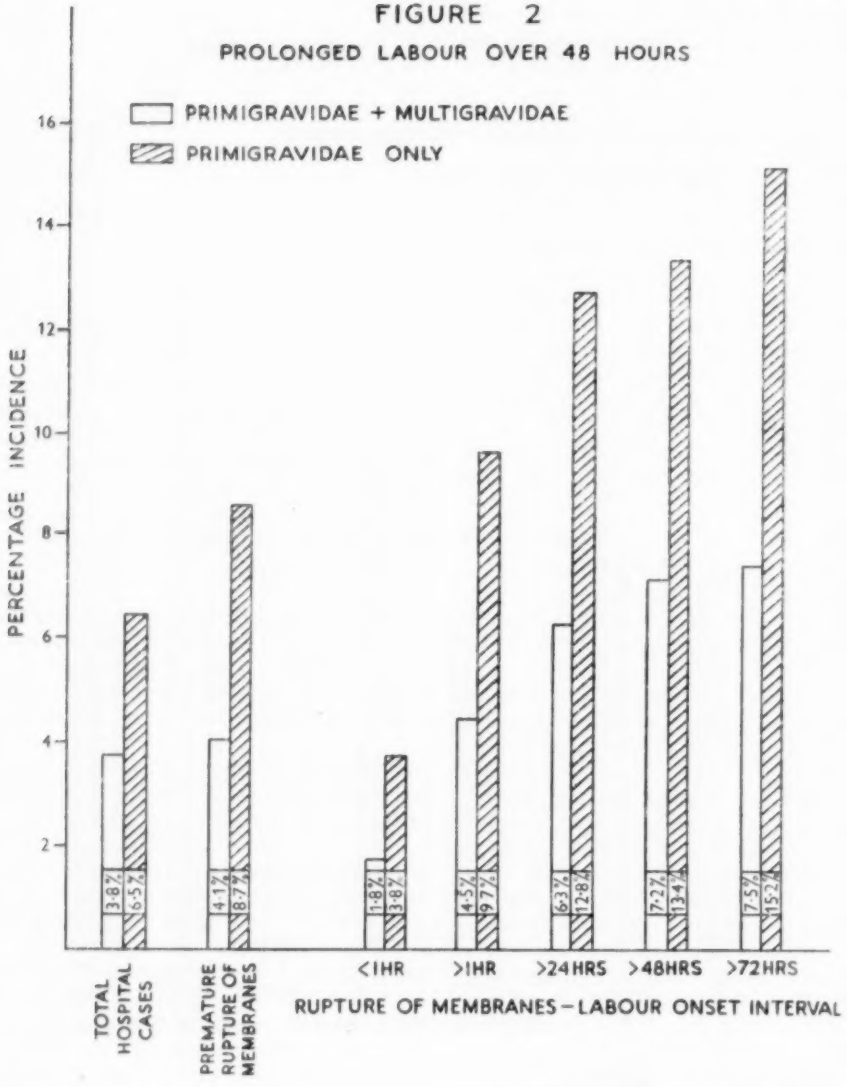


TABLE III

Maternal Morbidity—Percentage Rates

	Total	Notifiable
Total hospital cases	10.5	2.1
Premature rupture of membranes	11.3	2.4
Premature rupture of membranes over 48 hours	13.4	4.6

branes series, and with delay of 48 hours in the onset of labour the incidence of morbidity is still further increased.

Foetal Loss

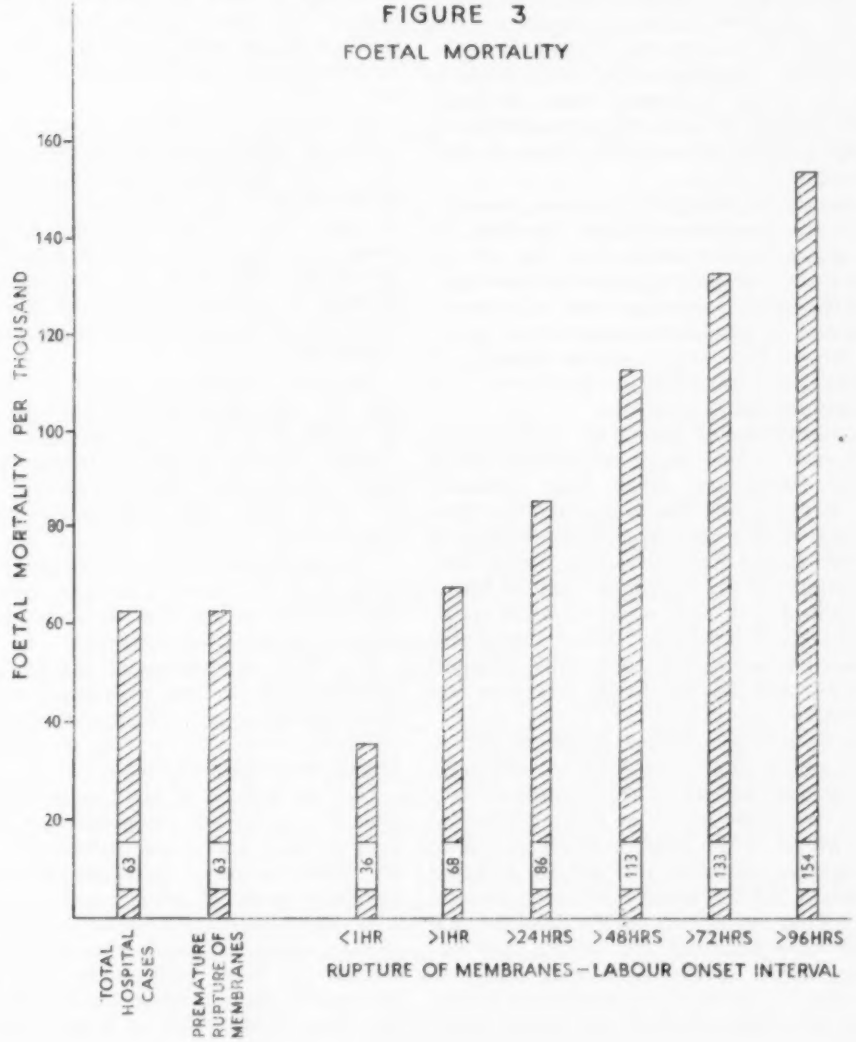
The total foetal loss in cases of premature rupture of the membranes comprised 40 stillbirths and 26 neonatal deaths—a total of 63 per

1,000. This compares favourably with the foetal loss for all hospital cases, which was also 63 per 1,000, and implies that the foetal danger is not increased in premature rupture of the membranes.

But to accept such a conclusion unreservedly without more detailed examination of the matter would be unwise. Fig. 3 demonstrates that, as with the length of labour, the risk to the foetus is, in fact, proportionate to the length of time the membranes have been ruptured before labour begins. When labour commences less than an hour after rupture of the membranes the results to the foetus are appreciably better than in the control group. With more than an hour's delay in the onset of labour the foetal risk mounts perceptibly. With 48 hours or more delay, the total foetal loss is doubled and—though the figures

FIGURE 3

FOETAL MORTALITY



now become small and statistical deduction therefore untrustworthy—when labour is delayed 96 hours the foetal loss is very nearly trebled.

Discussion

The traditional conception of a " dry " labour as being a prolonged and tedious labour with all its attendant evil consequences had its origin in the " fluid wedge " hypothesis of cervical dilatation elaborated by Denman (1805) more than a century ago. As a logical consequence it was postulated that in the absence of the " hydrostatic wedge " dilatation of the cervix would be slow and labour prolonged, whilst the foetus would be deprived of the protection afforded by the liquor amnii, with resulting danger to both mother and child.

It is only in comparatively recent years that such a view has been challenged, but there has now accumulated a considerable bulk of evidence that premature rupture of the membranes is not the serious happening it was once thought to be, and the pendulum of opinion has swung very far—perhaps too far—in the direction of regarding early rupture of the membranes as of little consequence.

For this change of opinion the work of Kreis (1934) must be held largely responsible, though Schulze (1929) and others had previously reported that labour was shorter and the foetal loss diminished in cases of premature rupture of the membranes. Kreis advocated routine artificial rupture of the membranes early in labour and claimed that, as a result, in 1,250 consecutive cases, (1) labour was shorter, (2) the need for intervention was less, whilst (3) the maternal morbidity and (4) the foetal loss were not increased.

Few obstetricians, perhaps, are prepared to go to the length advised by Kreis of employing early artificial rupture of the membranes as a routine procedure and Van Rooy (1933) and Essen-Möller (1936) have protested against it; but the latter and many other authors, including Fitzgibbon (1931), Guttmacher and Douglas (1931), Plass and Seibert (1936), and Wetterdal (1938), have confirmed the opinion that premature rupture of the membranes results in shortening rather than prolongation of labour. Indeed the published results are almost unanimous, and King in 1940 was able to collect and tabulate the results of 34 separate investigations to support his contention regarding premature rupture of the membranes—namely, that labour is shorter, that there is no worsening of the maternal or foetal prognosis, and that the need for interference is little, if at all, increased.

It is unnecessary to detail these results again, but it must be said that the bulk of evidence assembled to refute the old concept of a prolonged " dry " labour is most formidable and is for the most part supported by the more recently published papers by Morton *et al.* (1942) and Greig (1943).

Nevertheless, it is difficult to believe that the traditional teaching concerning premature rupture of the membranes, supported by so many astute obstetricians of the past and unassailed for more than a century, should be without foundation. There must surely be some basis for the gravity with which the complication was formerly regarded, and it was with this possibility in mind that the present investigation was undertaken.

Greig (1943) noted one clue to the old tradition, for whilst he concluded that " on average the length of labour is not increased ", he did observe " an increase in the incidence of prolonged labour over 30 hours " especially marked with delay in the onset of labour after escape of liquor amnii.

The justification for the old concept of " dry " labour is in fact revealed in those cases where there is delay in the onset of labour after premature rupture of the membranes.

Superficial examination of the figures now published indicates that on average the results of premature rupture of the membranes are not noticeably worse than in those patients with a normal onset of labour (Table IV).

The true picture, however, is only disclosed when the results are considered in relation to the rupture of membranes—labour onset interval. When rupture of the membranes is merely the initial event in labour, and is promptly followed by the commencement of uterine contractions, labour is usually more rapid, and the maternal and foetal results are better than when the onset of labour is normal. But with increasing delay in the onset of labour there is a

TABLE IV
Summary of results—percentage rates

	No. of cases	Prolonged labour >48 hrs.	Forceps	Caesarean section	Morbidity	Foetal mortality
Premature rupture of membranes	1052	4.1	7.4	3.1	11.3	6.3
Total hospital cases	7587	3.8	6.1	2.9	10.5	6.3

proportionate lengthening of the labour, more need for surgical intervention, and progressive deterioration in the results to mother and child.

SUMMARY

(1) A study of 1,052 examples of premature rupture of the membranes is presented.

(2) Rupture of the membranes before the onset of labour is not related to parity or antenatal complications.

(3) The high incidence of the complication in malpositions of the vertex, the various malpresentations and multiple pregnancy indicates the aetiological importance of a badly fitting presenting part.

(4) On average, the length of labour is not increased in cases where the membranes rupture prematurely. Indeed, when the complication is merely the initial event and followed within the hour by uterine contractions, labour is shortened. With delay in the onset of labour its length increases; with 24 hours delay the incidence of prolonged labour is increased by half and with 72 hours delay the likelihood of prolongation is doubled.

(5) The need for surgical intervention is little higher with premature rupture of the membranes than in normal cases, though it is increased when the onset of labour is postponed 48 hours or more.

(6) The maternal morbidity is only slightly increased in premature rupture of the membranes but is noticeably higher when only those cases with 48 hours delay in the occurrence of labour are considered.

(7) The foetal loss among cases of premature rupture of the membranes, taken as a whole, compares favourably with a control series and is actually diminished in cases where labour ensues in less than one hour. However, delay is unfavourable. Forty-eight hours postponement in the onset of labour doubles the foetal mortality and a 96-hour latent period trebles it.

(8) The results of this investigation serve to explain the divergent views expressed regarding the seriousness of premature rupture of the membranes. Rupture of the membranes with, or just before, the onset of uterine contractions is of little moment. But with delay in the onset of labour, the prognosis progressively deteriorates, labour is prolonged, there is greater need for intervention, and an increase in the maternal morbidity and foetal loss.

I have to acknowledge my indebtedness to Mr. H. J. Drew Smythe for permission to publish this report.

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FACE AND BROW PRESENTATION

BY

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PERSISTENT face or brow presentations are relatively uncommon and an obstetrician has little opportunity to acquaint himself with these cases until he has been in practice for several years. Even then his views may be prejudiced by results obtained in a small number of cases. Although there have been several recent American papers on this subject there has been no British series for comparison. The following analysis of cases which occurred at Hammersmith and Queen Charlotte's Hospitals during the years 1934–1950 indicates some of the difficulties which arise and the results which were obtained. As many features are common to both presentations, particularly in regard to aetiology, it is convenient to consider these together.

Incidence

One hundred and two face and 53 brow presentations are reviewed during a period when there were 64,817 deliveries in the hospitals concerned. This gives an incidence of 1 in 635 for face presentations. Allowing for exclusion of anencephalic monsters this figure compares with those given by Posner and Buch (1943) of 1 in 529, and Reddoch (1948) of 1 in 543.

On the other hand the incidence of brow presentation was 1 in 1,224, which is a lower figure than is given by other writers.

Aetiology

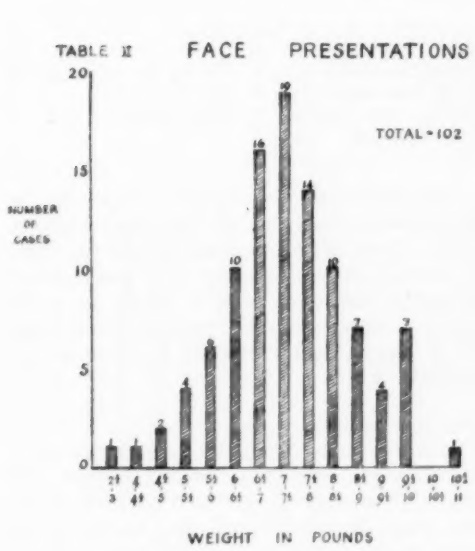
Most face and brow presentations are usually considered to develop just before or during labour. The extension of the head has been related to various factors both maternal and foetal. These different conditions as they occur in the writer's series are indicated in Table I.

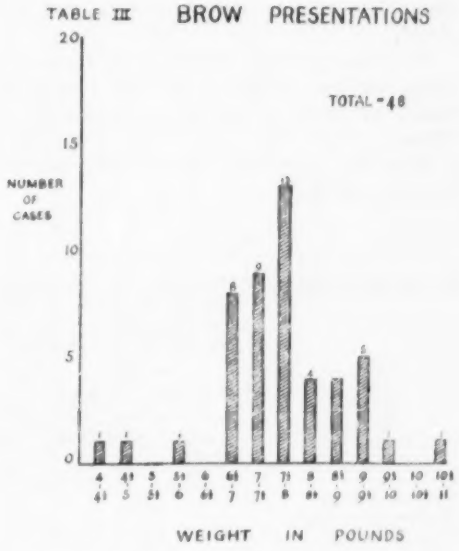
In this series, therefore, contracted pelvis appears to have been an uncommon association with face presentations, a finding in agreement with that of Reddoch (1948). Rudolph (1947) and Hellman *et al.* (1950), however, claim that it occurs much more frequently, the latter author describing its presence in 53 out of 141 cases. On the other hand pelvic contraction does seem a more frequent finding in brow presentations, being proved in 15.1 per cent of cases, whilst there were several other cases where it was suspected but never confirmed. The pendulous abdomen resulting from multiparity is a frequently quoted cause of a face or brow presentation. In this series, however, most patients were primigravidae and the majority of the multigravidae were only having their second or third child. Other writers report a much higher incidence of multiparity.

The coils of umbilical cord around the neck are claimed to act like a branchial tumour displacing the chin upwards; in this series in 1 case 6 coils were present. An alternative explanation has been advanced by Kleine (1931), who claims that the cord leaving the neck on its dorsal aspect exerts traction which first extends the cervical spine and then the head. Anencephalic monsters were not included in this series. The incidence of other types of foetal abnormality does not appear significant. They included 1 large meningo-encephalocele and 2 cases of hydrocephalus. Vartan (1949) and Wilkin (1951) have both recently directed attention to primary face and brow presentations. They consider that these result from increased extensor tone. In this series relatively few face and brow presentations were diagnosed before labour began. Many, however, may have been missed. Figs. 1 and 2 illustrate one of these cases which was initially a breech presentation with marked head extension. Following version the extension persisted. After delivery all these infants were noted to remain hyperextended for some period and in

TABLE I

	Number of cases	
	Face	Brow
Maternal factors		
Contracted pelvis	6	8
Parity: Primigravidae	59	33
Multigravidae	43	20
Placenta praevia, pelvic fibromyomata, ovarian cyst, abnormalities of uterine development	Nil	Nil
Foetal factors		
Umbilical cord around the neck	4	3
Foetal abnormality (excluding anencephaly)	3	3
Primary face or brow	3	2
Twins	2	2
Prematurity (under 5 pounds 8 ounces)	8	8
Large baby (over 8 pounds)	29	15
Rupture of the Membranes		
Records available in	81	30
Artificial, premature, or early rupture in	49	23





These tables illustrate the respective weight of infants in both series.

one instance this persisted for 2 months. This observation does not appear true for face and brow presentation in general, however.

Where multiple pregnancy was an associated factor, in each case the other twin was delivered as a vertex presentation. Prematurity has been advanced as a possible aetiological factor in face and brow presentations, but it was of little significance in this series. Rudolph (1947) and Posner and Buch (1943), however, recorded an association with large infants. Tables II and III indicate the foetal weight distribution in the present series; 28.4 per cent of face and 31.3 per cent of brow presentations weighed over 8 pounds. It has been claimed that this may result in cephalo-pelvic disproportion.

Premature and early rupture of the membranes was a very frequent association and may well be a factor of some importance. If the membranes rupture when the head is deflexed it will tend to be trapped in this position, from which further extension may more readily develop.

Diagnosis

Face presentation. Table IV indicates the time when the face presentation was first diagnosed.

It can be seen that the diagnosis was usually made very late in labour. In only 4 cases was actual extension of the head observed during labour; in 3 of these extension developed from a brow and in another from a right occipito-posterior position.

TABLE IV

During pregnancy	3	(including one diagnosed on vaginal examination before attempting an artificial rupture of the membranes).
	1	case was diagnosed as a brow which subsequently extended to a face during labour.
Early first stage	25	
Midway first stage	5	
Late first stage	6	
During second stage	45	
At delivery	17	

TABLE V

Left mento-anterior ...	24	81 (79.4 per cent)
Right mento-anterior ...	18	
Mento-anterior	39	
(Precise position not recorded)		
Left mento-transverse ...	1	
Right mento-transverse ...	1	
Right mento-posterior ...	9	18 (17.6 per cent)
Left mento-posterior ...	9	

The positions recorded are indicated in Table V.

In 1 case no position was indicated. This table is interesting in that, compared with the findings of other writers, relatively few posterior positions were recorded.

It will be seen later that, of the mento-posterior positions diagnosed, in 4 Caesarean section was performed either as an elective procedure or early in labour. Of the remainder, 8 underwent spontaneous rotation to a vertex and only 6 required some form of manipulative vaginal interference.

Brow presentation. Table VI indicates the stage when the brow presentation was first diagnosed.

TABLE VI

During pregnancy ...	2	During second stage	18
Early first stage ...	9	At delivery	2
Midway first stage ...	8	Not recorded ...	7
Late first stage ...	7		

This table demonstrates how frequently the diagnosis was missed until very late in labour, often a factor of serious significance. Even many of those cases classified as early and midway first stage had often been in labour for many hours. Unfortunately the precise position of the brow was seldom recorded; hence it is not possible to give any figures.

Duration of Labour

It is frequently stated that face presentations are associated with long labours. Tables VII and VIII indicate the recorded duration of the first stage in primigravidae and multigravidae respectively. In general there was little tendency towards prolonged labour but in 8 primigravidae (15.1 per cent) the first stage lasted for 36 hours

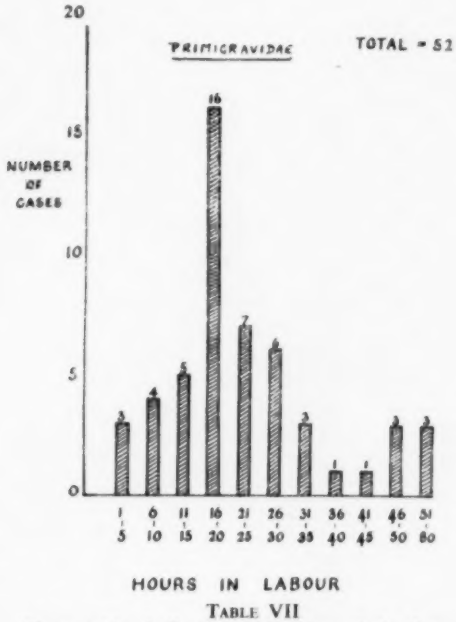


TABLE VII

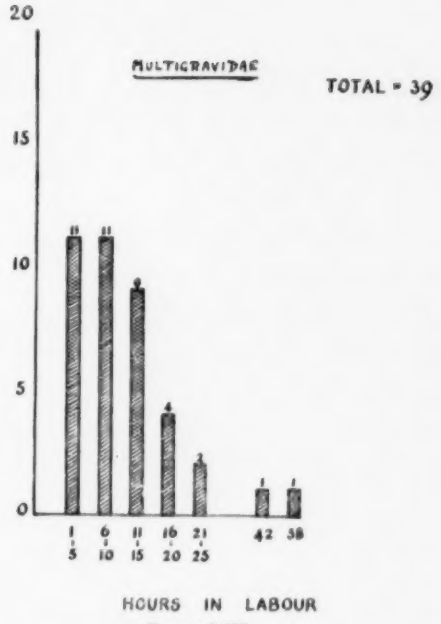


TABLE VIII

These tables indicate the duration of the first stage in face presentations in primigravidae and multigravidae respectively.

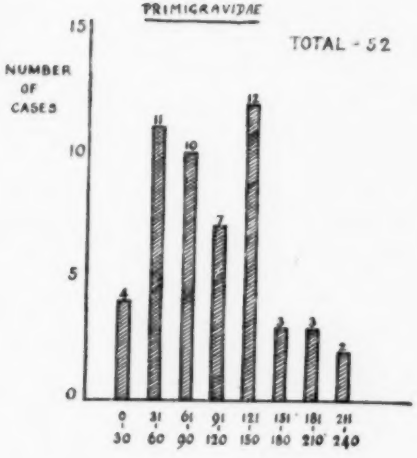


TABLE IX

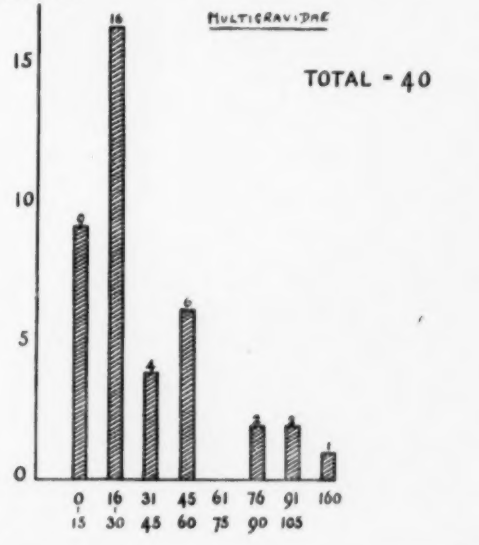


TABLE X

These tables indicate the duration of the second stage in face presentations in primigravidae and multigravidae respectively.

or more. In 2 multigravidae labour was also recorded as rather prolonged.

The second stage is also said to be longer than usual as the facial bones mould less readily than those of the vault. Tables IX and X indicate the recorded duration of the second stage in this series. It is seen that in 20 primigravid cases (38.5 per cent) the second stage lasted for over 2 hours and this includes many where delivery was aided by forceps application. In multigravidae, on the other hand, the second stage usually was of average duration.

A full record of the duration of labour in the brow series would be rather misleading since in many of the emergency cases no adequate record was available, whilst in others it was foreshortened by Caesarean section. Labour when allowed to proceed was in nearly every instance very prolonged.

Method of Delivery

Face presentations. 39 primipravidae (66 per cent) and 39 multigravidae (91 per cent) delivered spontaneously. In this group there was a foetal mortality of 7, but in all save one, which died from cerebral haemorrhage, some other factor appeared responsible for the foetal death.

Low forceps application was required in 9 cases; 2 infants were stillborn but 1 of these was grossly abnormal. Manual rotation of a mento-posterior position followed by forceps application produced a living infant in 4 out of 5 cases. Correction of a mento-posterior position to an occipito-anterior was only performed in 2 cases, in 1 of which the infant was stillborn. Of 2 persistent mento-transverse positions one was corrected with Kielland's forceps and in the other, manual rotation having failed, an internal version was performed, following which a constriction ring developed, the infant being stillborn.

Lower segment Caesarean section was performed in only 5 cases, in 4 of which there was a mento-posterior position, whilst in 2 the pelvis was contracted. All the infants survived.

The total uncorrected foetal mortality was therefore 12 (11.8 per cent).

Brow presentations. Spontaneous delivery occurred in only 7 cases (13.2 per cent). These included 2 persistent brow presentations, the infants weighing 5 pounds 8 ounces and 7 pounds 10 ounces respectively. Three cases flexed spontaneously to a vertex presentation and delivered normally, whilst the remaining 2 cases extended to a face presentation and also delivered spontaneously. Only 1 infant was lost in this group, dying from cerebral haemorrhage.

Flexion to a vertex presentation was attempted in 19 cases but only succeeded in 12, 2 infants being stillborn. Extension to a face presentation was attempted in 11 cases, but was only successful in 6, 1 infant being stillborn.

Bipolar version was performed in only 1 case, the infant surviving.

Internal version was attempted in 9 cases but succeeded in only 6, the infant being stillborn in 4 of these. In 1 case where version failed the uterus was ruptured. Caesarean section was performed in 19 cases (35.8 per cent), 4 infants being stillborn with 1 neonatal death. No infants were lost however when the operation was performed within 48 hours of the onset of labour.

Craniotomy was required in 2 cases where previous manoeuvres had failed.

The total uncorrected foetal mortality was therefore 15 (28.3 per cent).

Morbidity

This was defined as a temperature of 100.4° F. sustained or recurring during any period of 24 hours for 21 days following delivery. According to this standard 11 of the patients with a face presentation had puerperal morbidity but it was usually of short duration.

On the other hand, in 17 (32 per cent) of the patients with a brow presentation the puerperium was morbid, and often seriously so; all the mothers however survived.

Mortality

One mother died on the third day from heart failure; she had been treated for cardiac disease (Grade III) and there was no evidence that the face presentation contributed towards her death.

Discussion

Aetiology

Since so few cases presented any factor which might account for extension of the head, and also the process of extension was so seldom observed during labour, there appears reason to suspect that a primary face or brow

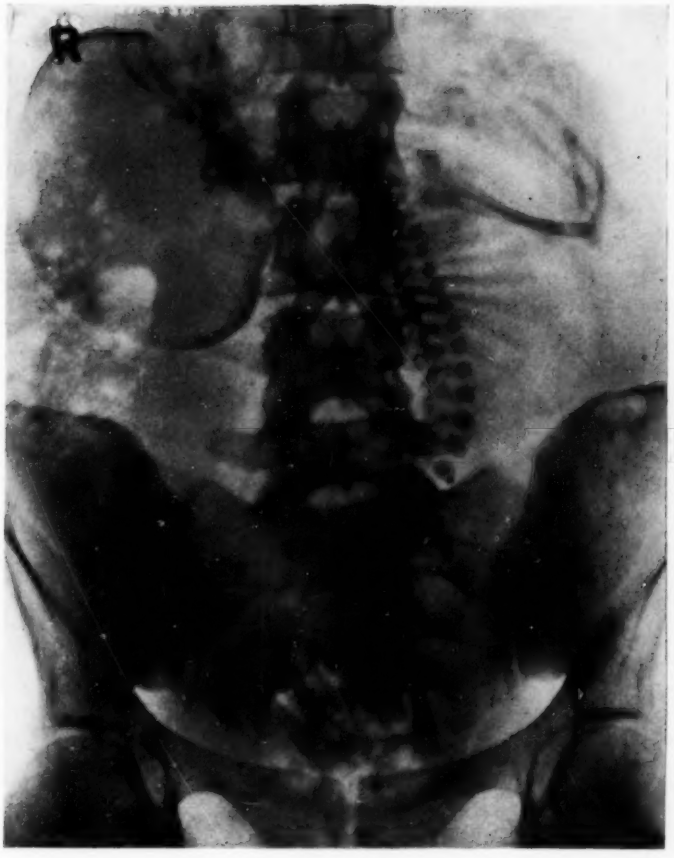


FIG. 1

This radiograph demonstrates the marked extension of the foetus as a breech presentation.

N.M.

FIG. 2

This radiograph of the same patient as in Fig. 1 shows the persistence of the extension of the foetal head after external cephalic version, even though this X-ray was taken 13 days later when labour commenced.

presentation occurs more frequently than has been previously supposed. If this is true then increased extensor tone in the foetus may be an important factor in many of these cases.

The only other significant observation was the frequency of premature or early rupture of the membranes, which, as suggested, may trap the head when it is in an attitude of deflexion from which further extension may more readily develop.

Management

Face presentation. When a face presentation is diagnosed during late pregnancy two infrequent, but nevertheless important, associations require to be excluded, namely foetal abnormality and pelvic contraction. X-rays are therefore of considerable value in this respect.

The Schatz manoeuvre for correction of a face presentation to a vertex is illustrated in most obstetric textbooks and yet in practice it seems that this method is seldom attempted and even more rarely successful. Kerr and Moir (1949) believe that, whilst this manoeuvre is excellent in theory, it is most difficult to accomplish. Posner and Buch, on the other hand, claim that it was successful in several of their cases.

When the chin is anterior it has been seen that in the majority of cases labour proceeds relatively normally; hence, if pelvic contraction has been excluded, spontaneous delivery can be anticipated in most of these cases. The only further complication to be suspected is the presence of the cord around the neck; hence regular auscultation of the foetal heart is required.

If a persistent mento-posterior position is detected before labour many authorities now favour elective Caesarean section, on the assumption that few of these cases will ultimately rotate and deliver spontaneously. Munro Kerr gives an estimate that only 20–30 per cent of cases do ultimately rotate successfully. However, in this present series, of the 14 cases where labour was allowed to proceed, 8 underwent spontaneous rotation and delivered normally. In Hellman's series 19 of the 39 cases of mento-posterior position rotated spontaneously and all except one delivered normally. It is possible therefore that Munro Kerr's figure is a little pessimistic. There seems therefore some justification for the attendant allowing labour to proceed under careful observation and being prepared to intervene should progress prove unsatisfactory.

When the patient is in labour Munro Kerr prefers to correct the mento-posterior position as soon as the cervix is sufficiently dilated to permit the passage of a hand into the uterus. He then performs DeLee's modification of Thorn's manoeuvre for correction to an occipito-anterior position. Greenhill (1951), on the other hand, only interferes if the head remains high.

Although Zeigenspeck's manoeuvre is also described in the textbooks for correction of the head when the cervix is only 2-fingers dilated this method appears to be seldom practised. Mussio and Walker (1941) only attempted this in 1 of their cases and produced a brow presentation.

Once the second stage is reached it is obviously most unwise to wait too long for spontaneous rotation to occur. Undue delay may allow the face to jam down tightly in the pelvis and preclude any later attempt to obtain correction. The optimum time for interference will therefore depend to a considerable extent upon the nature of the uterine contractions. The face can then either be manually rotated to a mento-anterior or converted to an occipito-anterior position. With the face well down in the pelvis the former method seems preferable since attempts at flexion require the displacement of the head out of the pelvis above the pelvic brim. In Hellman's series conversion to an occipito-anterior position was attempted in 9 cases but successful in only 5. Kurzrock (1943) describes the use of Kielland's forceps for the correction of mento-transverse positions. It is suggested that these can also be used for mento-posterior positions if the face is initially manually rotated to the transverse position. When the face, with the chin posterior, is impacted deeply in the pelvis and the foetus is alive, lower segment Caesarean section is clearly the method of choice.

Internal version seems to have little application in the hospital management of face presentations, since it is associated with a high foetal mortality and, as the liquor has usually

long since drained away, there is considerable risk of uterine rupture. In Reddoch's series 27 internal versions were performed and in 15 the infant was lost, whilst Hellman *et al.* describe 8 cases in which 4 infants were stillborn.

Brow presentation. The high foetal mortality in this series underlines the need for skilled obstetric care of these cases. Too frequently the diagnosis was missed until labour had been in progress for many hours with the membranes ruptured. This factor alone was frequently of most serious significance. Where a free head is associated with early rupture of the membranes and a long labour, particularly in a multigravida, the possibility of a brow presentation should therefore always be considered. If vaginal examination still leaves the diagnosis in doubt X-ray examination may then be of considerable value. Frequently the excessive moulding which occurs in these cases gives a false impression that the head is much lower in the pelvis than is actually the case.

In all cases of brow presentation care must be taken to exclude the presence of pelvic contraction, which appears a more frequent association than in face presentation. If a brow presentation is diagnosed during late pregnancy attempts at correction by means of posture or the Schatz manoeuvre seem worthy of trial. If the presentation persists there may be serious objection to allowing labour to proceed normally, particularly in a primigravida. Greenhill, however, considers that most cases diagnosed in pregnancy or early labour ultimately convert spontaneously either to a vertex or to a face. For this reason he is prepared to allow labour to proceed. This hypothesis is certainly not true for the present group of cases, since spontaneous delivery occurred in only 7 (13.2 per cent) of these, whilst in Hellman's series 31.1 per cent delivered spontaneously. It can of course be argued that some cases were missed, as early conversion occurred before the position was diagnosed.

Sjövall (1934) in his review recommends the early conversion of brow presentations unless the membranes remain intact. Munro Kerr supports this view and his decision as to whether the head should be flexed or extended is based upon the position of the occiput. If this is anterior, which in his experience is more common, he flexes the head, if posterior he extends the brow to a face presentation.

Another observation which can be drawn from this present series is that, whilst conversion to a vertex or face presentation may sound simple in theory, these manoeuvres often prove most difficult in practice and frequently fail. It is possible to visualize from the records the almost frantic efforts to convert the brow into one presentation or another. In several of these cases it is likely that the optimum time for such attempts had long since passed, since the patient had often been some time in the second stage.

With this possibility of failure in mind, together with the known association with incoordinate uterine action and high foetal mortality, there seems considerable justification for practising Caesarean section in most primigravidae who are found to have a brow presentation. If this is considered too radical a view then a plea is advanced that, before attempts at conversion are begun, preparations should be made for immediate Caesarean section should these manoeuvres fail.

There is considerably more justification for attempting conversion in a multigravid patient but even here care should first be taken to exclude the presence of pelvic contraction.

Internal version, as in face presentation, appears to have little place in the present-day treatment of brow presentation. Craniotomy will only be required when the foetus is known to be dead or abnormal.

Summary

1. The aetiology, management and results of 102 face and 53 brow presentations in labour are analyzed.

2. Relatively few cases presented any factor which explained the extension of the foetal head, although premature and early rupture of the membranes was a very frequent association.

3. The diagnosis of both face and brow presentations was usually not made until late in labour. This was often of serious significance in relation to brow presentations.

4. Face presentation in a primigravida tends to prolong both the first and second stage but in

multigravidae labour usually proceeds normally. Labour in nearly every case of brow presentation was very prolonged.

5. Spontaneous delivery of a face presentation occurred in 66 per cent of primigravidae and 91 per cent of multigravidae.

6. Of the 14 mento-posterior positions recorded 8 subsequently delivered spontaneously.

7. Only 13 per cent of brow presentations delivered spontaneously. Attempts to flex the brow to a vertex failed in 7 cases out of 19, whilst extension failed in 5 cases out of 11.

8. Where Caesarean section was performed for a brow presentation within 48 hours of the onset of labour no infants were lost.

9. The total uncorrected foetal mortality for face presentation was 11.8 per cent, whilst for brow presentation it was 28.3 per cent.

10. The management of face and brow presentations is discussed and a plea is advanced for the more frequent use of Caesarean section when a primigravida is found to have a brow presentation.

I wish to thank Professor J. C. McClure Browne for his permission to analyze the case records at Hammersmith Hospital and also for his help in the preparation of this paper.

I am also indebted to Mr. Arthur Bell and the Medical Committee of Queen Charlotte's Hospital for granting me access to case records, and to Dr. Rohan Williams for permission to publish the X-rays shown in Figs. 1 and 2. Miss P. M. J. Jacobson and Mr. J. Slowe have also given me invaluable assistance by tracing the records of the cases which have been analyzed.

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ACUTE INTESTINAL OBSTRUCTION COMPLICATING PREGNANCY

Report of Two Cases

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ACUTE intestinal obstruction is a rare complication of pregnancy. Maternal mortality has been high in the reported cases, due often to the difficulty of early diagnosis. The two cases here reported well illustrate the difficulties and dangers in diagnosis and treatment.

Intestinal obstruction should always be suspected when abdominal pain of obscure origin occurs in pregnant women. If the other signs are present, operation should not be long delayed. These cases are fraught with difficulty; they demand close co-operation between the general surgeon and the obstetrician; and the operation, when decided on, should be carried out under the best conditions and with facilities for any special treatment that may be required.

CASE REPORT 1

Mrs. E. M., was aged 30 and primigravida. The last menstrual period was on 30th June, 1950. The expected date of delivery was 7th April, 1951.

Past History. She had appendicectomy in Berlin in 1935. Of this no details are available.

Antenatal Period. There was normal progress. The highest blood pressure was 140/80 on 30th January, 1951. The urine was albumen free. Sugar was constantly present. This was shown by Dr. Charles Dent of University College Hospital to be pentose. The foetus developed normally; the head engaged from the 30th week. The blood group was O, Rhesus positive. The haemoglobin was 84 per cent on 26th September, 1950.

On 9th March, 1951, she was admitted to the Maternity Department of Elizabeth Garrett Anderson Hospital with severe abdominal pain and vomiting. The bowels had not been opened for 2 days. Colicky abdominal pain continued and a doubtful mass was palpable in the upper right quadrant of the abdomen. Pregnancy was apparently normal. The foetal heart was heard.

On 11th March, 1951, there was no result from 2 enemata. Towards evening a Ryle's tube was passed; some yellow fluid characteristic of intestinal contents was withdrawn. On rectal examination the rectum was found to be empty; some blood appeared on the examining finger. A diagnosis of intestinal obstruction was made and laparotomy decided on.

Operation. A general anaesthetic was administered; curare, pentothal, nitrous oxide, oxygen and ether were given.

The abdomen was opened through a right paramedian incision, and the peritoneal cavity was found to contain a quantity of blood-stained fluid. The pregnant uterus occupied most of the abdominal cavity and, to make exploration easier, lower segment Caesarean section was performed. The uterus contracted well and was sewn up in layers. The abdominal incision was then enlarged, revealing a large mass in the middle of the abdominal cavity. This proved to be the transverse colon, containing an intussusception involving the ascending colon, the caecum and a large part of the small bowel. Tentative efforts at reduction produced a slight flow of black fluid. As this suggested that the contents were gangrenous, resection of the mass was decided on. Paul's tubes were inserted into the cut ends of the transverse colon and of the small bowel. The mass was removed and the abdomen closed.

Normal saline and blood were given intravenously during the progress of the operation, at the end of which the patient's condition was moderately good. Sulphadiazine and chloramphenicol were given postoperatively.

Second Operation. On 27th March, 1951 (i.e. 16 days after the first operation), an operation under general anaesthesia was performed to anastomose the cut ends of the transverse colon and the ileum. Pentothal, tubarine, nitrous oxide and oxygen were given.

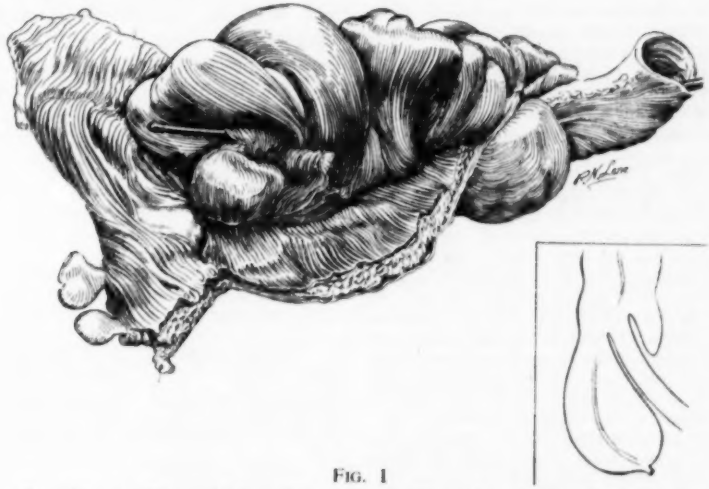

FIG. 1

CASE NO. 1. The excised portion of bowel. The point of the probe emerges at the apex of the intussuscipiens. Below the probe is the polyp. The entire intussuscipiens was gangrenous. Inset shows site of intussusception.

It was obvious at this operation that the ileum had been divided very high up. Subsequent radiological examination confirmed this. The patient was well at the conclusion of the operation, but after return to the ward suddenly developed a very rapid pulse, and had an exceedingly stormy convalescence, the pulse rate remaining over 150 for several days. Eventually she made a good recovery, a small faecal fistula closing spontaneously. She was discharged well on 6th May, 1951.

The infant was a healthy, premature child weighing 5 pounds 4 ounces. She had a well-marked left talipes equinovarus, but otherwise gave no trouble.

The Specimen. Report by Dr. Joan Haram: the specimen consists of part of the ascending colon, the caecum, and part of the ileum, forming an ileo-caecal intussusception, the apex of which is a pedunculated polyp with a stalk approximately 1 inch long, and a head 1¼ inches in diameter. Approximately 24 inches of ileum has intussuscepted and the gut is almost entirely gangrenous.

Radiological Report by Dr. D. C. Staveley. 31st October, 1951. The stomach and duodenum are normal. The emptying rate is rapid. Four and a half hours p.c. the ileum is seen anastomosed to the transverse colon. The last part of the ileum shows a coarse mucosa. The descending colon is spastic. Twenty-four hours p.c. none of the meal remains.

Conclusion. There is some local irritation of the terminal ileum.

CASE REPORT 2

Mrs. J. A., aged 29 and primigravida, had her last menstrual period on 22nd December, 1950. The expected date of delivery was the 23rd September, 1951.

Past History. This revealed nothing of significance.

Antenatal Period. The progress of pregnancy was normal. The highest blood pressure was 120/70.

The patient was admitted to Paddington Hospital when she was 20 weeks pregnant and remained there for 2 weeks. She was complaining of intermittent abdominal pain, and was found to be extremely tender in the right loin. Pus cells, albumen and a scanty growth of *Bacterium coli* were found in the urine. After treatment with sulphatriad she became symptom-free and was discharged. The patient gave a history of colicky abdominal pain with gurgling during the latter half of pregnancy, and was constipated during that time. The patient was admitted at 8 p.m. on 18th September, 1951, to the Maternity Department of the Elizabeth Garrett Anderson Hospital complaining of intermittent abdominal pain for 24 hours and of vomiting for 3 hours. She had not had a bowel action for 2 days. Her general condition was good, pulse 80, temperature normal and blood pressure 120/85. The colon appeared distended. The patient vomited frequently during the night, and no result was obtained from a soap enema. An intravenous drip was started and the patient had 3 pints of glucose and saline. On 19th September, 1951, vomiting stopped and uterine contractions started at 12.30 p.m., the patient being delivered of a healthy female child at 2.50 a.m. on 20th September. It was noted that no flatus was passed all that day. A stomach tube was passed and a little mucus only was withdrawn.

The following day vomiting restarted and the

patient looked ill. A distended caecum could now be seen, and there was visible peristalsis and colicky abdominal pain. Attempts to pass a Ryle's tube produced a copious vomit, which, for the first time, was coloured brown. Intestinal obstruction was diagnosed. The patient was seen by a general surgeon, the diagnosis confirmed, and the decision made to operate immediately.

Operation. On 21st September the abdomen was opened by an upper right paramedian incision. The obstruction was found to be due to a small tight constriction by a malignant growth in the splenic flexure of the colon. A purse-string suture was inserted into the anterior aspect of the middle part of the transverse colon. A trocar was passed into the bowel and the suture tightened to hold it. Gas and bowel contents were allowed to escape. The very considerable distension of the large bowel having been thus reduced, the lower part of the abdominal incision was closed in layers, and a Paul's tube inserted into the exposed part of the transverse colon.

A Ryle's tube was retained in the stomach and intravenous fluid given continuously until the Paul's tube was draining, which happened 28 hours after operation. The patient's condition gave rise to no anxiety in the postoperative period.

Second Operation. On 9th October excision of the growth and end-to-end anastomosis was carried out through an oblique incision in the left upper quadrant of the abdomen. The portion of colon excised included the colostomy and about 5 inches of the descending colon. End-to-end anastomosis was done, and the abdomen closed without drainage of the abdomen or of the peritoneum. The patient made an uneventful recovery, except for slight skin sepsis at the site of the excised colostomy. She was discharged on 5th November. She was last seen on 7th December, 1951, when she had returned from convalescence and was very well.

The infant was a full-time, healthy female child, weighing 5 pounds 13¼ ounces. She thrived normally.

The Specimen. Report by Dr. Joan Haram: the specimen consists of a portion of the large bowel approximately 12 inches in length, and comprising the transverse colon, the splenic flexure and part of the descending colon. An annular constricting growth encircles the bowel and almost completely obstructs the lumen at the splenic flexure, about 4 inches above the distal end of the specimen. The growth has hard raised edges and appears to be invading the bowel wall, causing puckering on the peritoneal aspect. The colostomy opening can be seen in the portion of bowel which has been exteriorized. Section of the growth shows a partly differentiated adenocarcinoma, which is invading all coats of the bowel wall. The growth shows marked mucoid degeneration. Two mesenteric glands showed very early invasion by small groups of carcinoma cells.

Literature

The literature on the subject of intestinal obstruction in pregnancy is extensive, Slemon and Williams (1938) finding over 1,000 references to the subject. Most of these consist of reports of one or more cases. Summaries of larger series have also appeared. Ludwig (1914) collected 95 cases which he tabulated as follows:

Adhesions	28
Volvulus	13
Pregnancy ileus	10
Arteriomesenteric	1
Tumours	25
Obturation (foreign bodies)	7
Intussusception	4
Hernia	7

The maternal mortality in this series was 55 per cent. Von Mikulicz-Radecki (1926) described 81 cases collected between 1914 and 1925. He tabulated these as follows:

	No.	*Maternal mortality*
Adhesions	15	6
Volvulus	34	14
Intussusception	3	3
Tumour	4	2
Hernia	1	1
Pressure of pregnant uterus		
Certain	10	2
Uncertain	8	—
Unknown	6	—
Total	81	28 (39.4 per cent)

Eliason and Erb (1937) summarized 66 cases collected from the literature between 1925 and 1937 as follows:

	No.	*Maternal Mortality*	*Per Cent*
Adhesions	14	3	21
Volvulus	11	4	36
Tumour and cysts	7	2	29
Paralytic (inflammatory)	4	2	50
Hernia	2	—	—
Pregnancy ileus	28	3	11
Total	66	14 or	21

These series have been collected from very wide surveys and the rarity of intestinal obstruction in pregnancy must be stressed. Thus Smith and Bartlett (1940) found that at the Boston

Lying-in Hospital in 66,431 deliveries there were 61 abdominal complications but only 1 case of intestinal obstruction. Bemis (1932) found that at the Woman's Hospital, New York, intestinal obstruction had occurred only twice in 15,000 obstetric cases. Bellingham, Mackay and Winston (1949) found that 10 cases had occurred at the Women's Hospital, Sydney, an incidence of 0.34 per 1,000 confinements; maternal mortality was about 30 per cent and 50 per cent of the cases occurred during the middle trimester of pregnancy.

Slemon and Williams (1938) found three main times of predilection for intestinal obstruction in pregnancy, at 4 to 6 months of gestation, near term or during labour, and shortly after delivery. They gave, as the main causes, intussusception, volvulus, hernia, tumours, adhesions or bands, foreign bodies, and true pregnancy ileus. The last-named condition, " pregnancy ileus ", is extremely rare, but most authors admit that it can occur. In this condition a paralysis of the smooth muscle of the gut, usually the large intestine, occurs without any organic obstruction, but with enormous distension. This is thought to be an extreme manifestation of the general tendency to smooth muscle atony that is seen during pregnancy.

Discussion

It will be obvious from the accounts of the 2 cases here presented that in both of them considerable difficulty in diagnosis and treatment was experienced. In the second case, intestinal obstruction was suspected from the time of admission. A temporary improvement in all the symptoms took place after delivery of the foetus, and this led to a further delay. In the first case it was not until the second day after admission that the presence of a severe degree of intestinal obstruction was confirmed. The diagnosis was then made on the presence of intestinal fluid in the stomach, although it had previously been suspected from the fact that no result was obtained with 2 enemata, and from the presence of blood on rectal examination. The localization of abdominal pain presented great difficulty in both cases, owing to the presence of the gravid uterus. In the second patient the onset of labour soon after admission clouded the issue still further. The difficulty of diagnosis of intestinal obstruction in pregnancy is stressed by almost every writer on the subject. Thus Simons (1950) described a case of volvulus of the caecum and pre-eclamptic toxaemia complicating labour. The case was diagnosed as concealed accidental haemorrhage and ended in a maternal death due to intestinal obstruction. Matthews and Mitchell (1948) also mention the difficulty of correct diagnosis as the classical signs of intestinal obstruction are not always present. They suggest the use of radiology, which may show gas and fluid levels; and also the " diagnostic enema ". If no result is obtained from one or more enemata this is highly suggestive. In the present cases this sign was positive and of great value in diagnosis. Another sign which proved of value in the first case, and which does not appear to have been mentioned by other authors, was the aspiration of intestinal contents by stomach tube.

The question of treatment is also a difficult one. No definite rules can be laid down as each case has to be considered on its merits and in the light of the obstetrical and surgical condition. In the first of the present cases, the condition of the patient after the Caesarean section and attempts to reduce the intussusception was too critical to warrant anything but simple resection with ileostomy and colostomy. Any attempt at an anastomosis of the bowel at this stage would almost certainly have proved fatal. DeLee (1940) recommended that, in cases before viability, laparotomy with relief of the obstruction be carried out, emptying of the uterus or not depending on the findings. After viability he recommended lower segment Caesarean section, followed by treatment of the ileus on general surgical principles. If it is thought that obstruction is being caused by the enlarging uterus alone, he advised induction of labour. He pointed out that ileus in the puerperium may be due to intestinal paresis due to the trauma of labour, to obstruction of the intestine by incarceration of the uterus, or to peritonitis.

It was felt by Bellingham, Mackay, and Winston (1949) that the occurrence of intestinal obstruction in pregnancy is becoming more frequent. If this is true it may be due to the greater frequency with which laparotomy and

especially appendicectomy is carried out; a high proportion of the cases are due to adhesions following appendicectomy or other abdominal operations.

Summary

(1) Intestinal obstruction is a rare complication of pregnancy but is associated with a high mortality, largely owing to the difficulty of diagnosis.

(2) A case is reported where acute intussusception of the ileum into the caecum occurred at the 37th week of pregnancy in a primigravida who had undergone appendicectomy 16 years earlier. The case was treated by lower segment Caesarean section, followed by resection of the intussusception, and ileostomy and colostomy. Anastomosis of the cut ends of the intestine was performed 16 days later. The mother recovered and the infant made satisfactory progress.

(3) A second case is reported in which colicky pain during pregnancy was followed by acute intestinal obstruction, due to a splenic flexure growth, during delivery at term. Transverse colostomy was performed the day after delivery, followed by excision and anastomosis 18 days later. The mother recovered and the infant did well.

(4) The problems of diagnosis and treatment raised by these 2 cases are discussed.

Our thanks are due to our anaesthetists, Dr. K. G. Lloyd-Williams and Dr. Margaret Taylor, without whose skill the history of these 2 cases might have been very different. The figure illustrating Case 1 was drawn by Mr. R. N. Lane. The second case was admitted under the care of Miss Beatrice Turner, *O.B.E.*, F.R.C.S., F.R.C.O.G., and we are grateful to her for permission to include the case record.

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PREGNANCY IN ADDISON'S DISEASE

BY

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THE occurrence of pregnancy in a patient with Addison's disease is a rare event. Knowlton, Mudge, and Jailer (1949) described their experience in the management of 5 cases and were able to collect reports of 39 others, but in some of the reports to which they refer the diagnosis of Addison's disease is open to question. Brent (1950) also quoted 39 cases in the literature and added another which terminated fatally at Caesarean section. In the Simpson Memorial Maternity Pavilion in Edinburgh, where there is an average of about 3,000 births a year, only 2 patients suffering from Addison's disease have been delivered in the past 20 years.

The patient with Addison's disease has to face serious hazards in pregnancy. During the first trimester vomiting is liable to occur which may precipitate an Addisonian crisis. During labour the stresses of physical exertion, haemorrhage, pain, and anaesthesia are inadequately borne, and in the early puerperium the physiological diuresis and excretion of sodium may again encourage the development of an Addisonian crisis. Moreover, in cases due to tuberculous destruction of the adrenals there is a danger of exacerbation or spread of the infection. The introduction of cortisone offers the physician a new weapon with which to ward off these hazards, and this paper describes its use in a case of pregnancy in Addison's disease.

Case history prior to pregnancy

The patient had suffered no serious illness before the birth of her first child when she was aged 31. This pregnancy and the delivery were normal and the child was healthy. Lactation ceased 3 weeks after the birth and at the same time the patient became irritable and depressed. She wept easily and for trivial reasons. She had a very poor appetite, lost weight, and was always tired. During the next few weeks her skin grew dark. She had only 2 brief periods of vaginal bleeding in the 9 months after delivery. She sought treatment and was admitted to hospital in August 1949, when her child was 9 months old.

Examination

On admission to hospital she was nervous and looked tired and thin, her weight being 113 pounds. There was a muddy brown pigmentation of the skin of both forearms and hands, around both eyes and in the temporal regions, on the anterior axillary folds, at both ankles, and around her waist. The nipples were very dark and there were dark brown freckles on the trunk. The blood-pressure was 114/74 mm.Hg. The fasting blood sugar was 62 mg. per cent, the serum sodium 321 mg. per cent, and the serum potassium 16.8 mg. per cent. The haemoglobin was 90 per cent (Sahli). X-ray examination showed no evidence of pulmonary disease or of calcification of the adrenals. In the first part of the Robinson-Power-Kepler test the volume of the "night urine" was 595 ml. and that of the largest hourly collection the next morning was 505 ml. By this time the patient was so ill that the second part of the test had to be abandoned.

Treatment

Daily intramuscular injections of deoxycortone acetate (DCA) led to a striking improvement and thereby confirmed the diagnosis. She soon felt much better, was less depressed, regained her appetite, and put on 14 pounds in 11 days. She had a menstrual period lasting 4 days and a normal menstrual rhythm was established thereafter. Subsequently she was

maintained as an out-patient on implants of DCA at intervals of about 6 months, but her condition was never wholly satisfactory. She suffered from intermittent depression and anorexia, and became tired on very moderate exertion, while at no time did she show any sign of over-treatment with DCA.

Pregnancy

In September 1950 she became pregnant for the second time. Despite the fact that she had an implant of 400 mg. of DCA a few days after the last menstrual period her condition deteriorated during the first trimester. Depression, a tendency to weep, and tiredness again became apparent, and her appetite was poor, but fortunately there was little vomiting. She was admitted on 7th December, 1950, and remained in hospital until after her delivery in June 1951. At first she was given daily injections of 5 mg. of DCA with the result that her weight increased by 7 pounds in the first 12 days. At this time she began to have acute attacks of bronchial asthma which were precipitated by emotional disturbances. These attacks were, however, easily controlled by subcutaneous injections of 1 : 1000 adrenaline solution.

At the end of December 1950, when she was in the 15th week of her pregnancy, supplies of cortisone became available and treatment with cortisone was continued until after delivery. For the first 10 days she received 100 mg. of cortisone acetate daily by intramuscular injection. Thereafter the dose was gradually reduced until it reached a level of 15 mg. daily in the 21st week of pregnancy. It was then maintained at between 10 mg. and 25 mg. daily until delivery. The injections of DCA were stopped in the 15th week when cortisone treatment began, but were started again in the 20th week in doses of 5 mg. of DCA twice a week. The dose of DCA was then gradually reduced to approximately 2 mg. once a week. The sodium chloride intake, including the salt content of her food as well as added salt, averaged 12.5 g. daily until the 28th week when it rose to 15 g. daily and was maintained at this level until delivery.

From the 15th week of pregnancy, when cortisone therapy began, there was a remarkable improvement in the condition of the patient. Her depression and tiredness disappeared, she no longer gave way to tears, and her appetite increased so that she felt hungry for the first time since she contracted Addison's disease. There was no recurrence of the occasional vomiting of early pregnancy. She had no asthma while having the higher doses of cortisone, but it returned in response to emotional upsets when the dose was reduced. Her weight rose steadily until at term she weighed 176 pounds, which was similar to her weight at the birth of her first child. She had moderate oedema of the legs and sacral region on 2 occasions, in the 26th and 27th weeks, but this was dispersed when the dose of DCA was reduced and the salt intake temporarily decreased. The blood-pressure readings remained between 110/70 and 124/80 mm.Hg until term. Transient glycosuria occurred on 2 occasions.

Fig. 1 shows the results of insulin sensitivity tests. Before she received cortisone an intravenous injection of 3 units of soluble insulin caused the capillary blood-sugar level to fall rapidly, and produced hypoglycaemic symptoms which were sufficient to necessitate the termination of the test by giving glucose by mouth. When she was having 25 mg. of cortisone daily, a repetition of the insulin sensitivity test did not produce a rapid fall in blood-sugar or hypoglycaemic symptoms, and the blood-sugar returned to the original level in 90 minutes. Fig. 2 shows the results of oral glucose tolerance tests done

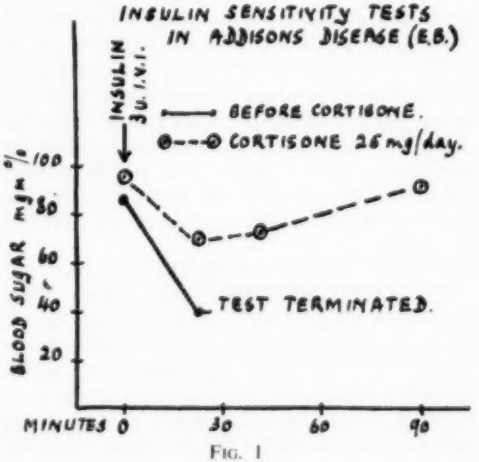

FIG. 1

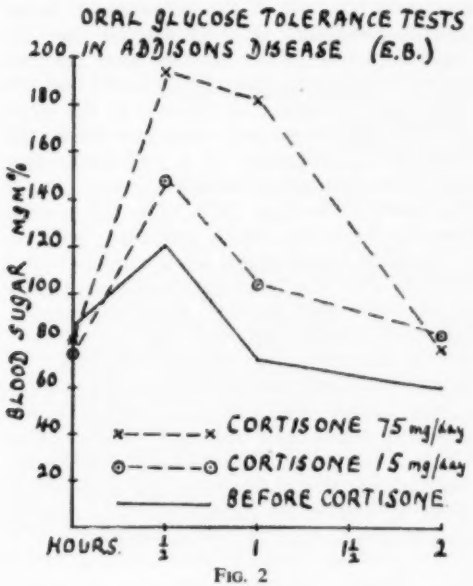

FIG. 2

TABLE I

Hormone Assays in Pregnancy in Addison's Disease

Week of pregnancy	Pregnanediol mg./24 hrs.	17-ketosteroids mg./24 hrs.	Gonadotrophins I.U./litre
17			5020
18			
19		4.3	
20			
21			3225
22			
23	16		3550
24		2.4	5640
25			
26			
27	30.7		
28			
29	36.3		
30	38.6		4380
31	47.7	4	
32			5140
33		4.6	
34			
35	41		4680
36			
37	36.8	5.9	4080
38	47.9		
39	32		
40	37.5		4180

before and during cortisone therapy. The dose of glucose was 50 g. and the figures are again for capillary blood.

Table I shows the result of estimations of the urinary excretion of pregnanediol and 17-ketosteroids, and of the serum concentration of chorionic gonadotrophin. The pregnanediol assays were done by the short method of Sommerville, Marrian, and Kellar (1948), the chorionic gonadotrophin assays by the method of Loraine and Gaddum (1950), and those of 17-ketosteroids by the method of Callow, Callow, Emmens, and Stroud (1939). The 17-ketosteroid excretion was low, as it always is in Addison's disease, but the pregnanediol and chorionic gonadotrophin estimations gave figures corresponding to those found in normal pregnancy.

Labour

As labour had not commenced spontaneously soon after the expected date it was induced by sweeping the membranes from the lower uterine segment. For the 3 days before labour the daily dose of cortisone was 25 mg. and a further dose of 50 mg. was given by intramuscular injection at the induction of labour. The head presented in the left occipito-anterior position. Half an hour after the onset of labour contractions were recurring frequently and the patient became distressed with shivering and vomiting; 5 mg. DCA was injected intramuscularly and an intravenous drip of 6 per cent glucose was infused slowly to a total volume of 600 ml. With constant encouragement a spontaneous delivery was accomplished within 3½ hours without difficulty. There was no undue bleeding and intravenous ergometrine was administered at the end of the third stage. No analgesic or anaesthetic drugs were used because patients with Addison's disease are notoriously intolerant to them. The baby weighed 8 pounds 4 ounces, and the placenta 1 pound 7 ounces.

Puerperium

On the 1st day of the puerperium she was given 10 mg. DCA and 50 mg. cortisone, and thereafter a daily dose of each hormone was given but gradually reduced. Cortisone was reduced to 10 mg. daily by the 7th day, and it was stopped on the 17th day as supplies were not at that time available for continuing treat-

ment with the drug in the patient's home. On the 14th day after delivery she was given an implant of 400 mg. DCA, and no further injections were required. The total intake of sodium chloride averaged 12.5 g. daily. Breast feeding was not permitted and lactation was suppressed by oestrogen therapy. Her weight fell from 176 pounds on the day before delivery to 159 pounds on the day of discharge. The puerperium was entirely uncomplicated and the patient was discharged home on the 21st day.

Discussion

Within the last 20 years only one other case of pregnancy in Addison's disease has been managed in this hospital. This was a woman of 34, who developed Addison's disease 1 year and 8 months before the time of her delivery. She had been been maintained in good health with DCA and sodium chloride, and remained well during her pregnancy, for the last month of which her treatment was supplemented by intramuscular injections of an aqueous adrenocortical extract (Cortin). In August 1945 she was delivered without difficulty and made a good recovery. The baby lived and thrived, but 6 months after delivery the mother died of Addisonian crisis precipitated by influenza.

The present patient had not been in good health before pregnancy despite maintenance therapy with DCA and salt, and it was feared that the onset of pregnancy would lead to a deterioration in her condition. When cortisone was used she improved to such a remarkable extent that her pregnancy was no longer a cause of anxiety, and she had a normal labour and delivery. As in the previous case, the baby survived and is now a normal healthy child, one year old. It is very doubtful whether such a successful outcome to this pregnancy would have been achieved without cortisone. The mother has remained in reasonably good health during the year after delivery, being maintained on implants of DCA and intermittent doses of oral cortisone at times of stress.

The results of the insulin sensitivity and glucose tolerance tests indicate that a definite change took place in the patient's carbohydrate metabolism under the influence of cortisone. This was accompanied by a decrease in the tendency to hypoglycaemia and probably accounted for some of the improvement in her general condition. It is of interest that the requirements of DCA decreased after the 27th week of pregnancy, and it is suggested that this phenomenon was due to increase in the secretion of progesterone and oestrogens during the latter half of pregnancy. It is well known that these hormones induce sodium retention, though to a lesser degree than DCA. The rise in pregnanediol excretion which coincided with the fall in DCA requirements lends support to this belief as does the immediate increase in DCA requirements after delivery. Knowlton, Mudge, and Jailer (1949) reported that the 17-ketosteroid excretion rises during pregnancy in Addison's disease, and made some observations on the possible sources of such steroids. In this case the estimations revealed figures rather higher than are usually found in Addison's disease, but the significance of this finding is in doubt as insufficient estimations were done in early pregnancy and before pregnancy.

Summary

The satisfactory management of a pregnancy in a woman with Addison's disease is described in detail, and reference is made to an earlier successful case. The use of cortisone appears to have been of great value. The labour was normal and conducted without anaesthetic or analgesic drugs. The development of the infant has been normal, and both mother and child are in good health one year after delivery.

We are grateful to Professor D. M. Dunlop and Professor R. J. Kellar for allowing us to publish this case and for their help and advice. We are indebted to Professor J. Gaddum for the estimations of chorionic gonadotrophin, and to Professor G. F. Marrian for the estimations of pregnanediol.

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THE GROWTH OF THE FOETAL HEAD IN THE LAST WEEKS OF PREGNANCY

BY

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IN 1875 Matthews Duncan emphasized the importance of the size of the foetal head in the conduct of labour and stated that the length of pregnancy and the sex of the foetus were factors affecting the size of the foetal head. Clark in 1886 stated that the larger heads of the males account for their greater mortality at birth. Scammon and Calkins (1929) included among their many measurements of the foetus various diameters of the head, and they found a direct relationship between biparietal diameter and crown–rump length, and estimated that the biparietal diameter increased by approximately 2.5 mm. a week during the last weeks of pregnancy. Josephs (1949), using a new radiological technique, came to the conclusion that no growth took place in the biparietal diameter of the foetus in the last 4 weeks of pregnancy, and it was this surprising finding that prompted this investigation.

In a previous communication (Macdonald, 1952) it was shown that the biparietal diameter of the foetal head increased in the last weeks of pregnancy. In this present paper changes in the occipito-frontal and sub-occipito-bregmatic diameters of the foetal head in late pregnancy and the relationship between these measurements, including the biparietal diameter and the sex of the foetus, are described.

METHODS

The occipito-frontal, sub-occipito-bregmatic, and biparietal diameters of infants were measured within 48 to 96 hours of birth with steel calipers fitted with a sprung platform so that standard conditions of pressure for every measurement were ensured. The length of gestation was estimated from the first day of the last menstrual period of the mother as recorded on the antenatal notes. The method of delivery, birth weight, and sex of each infant were also noted. Single pregnancies only were considered.

RESULTS

The head diameters of 1,272 infants were measured, 189 being rejected because of uncertainty of the duration of gestation. Of the remaining 1,083 cases 24 were delivered as a

TABLE I

Data on Occipito-frontal Diameter, and Number of Cases in each 7-day Period of Late Pregnancy

Weeks	35–36		36–37		37–38		38–39		39–40	
Sex	M	F	M	F	M	F	M	F	M	F
Mean measurement (cm.)	11.44	11.33	11.48	11.10	11.66	11.47	11.82	11.64	11.96	11.67
Standard deviation	0.54	0.42	0.47	0.38	0.39	0.48	0.38	0.47	0.35	0.35
Number of cases	11	7	15	12	30	28	51	43	130	118

Weeks	40–41		41–42		42–43		43–44	
Sex	M	F	M	F	M	F	M	F
Mean measurement (cm.)	12.08	11.87	12.09	11.94	12.20	11.88	12.16	12.14
Standard deviation	0.46	0.30	0.42	0.39	0.44	0.45	0.23	0.43
Number of cases	136	159	103	92	55	41	15	13

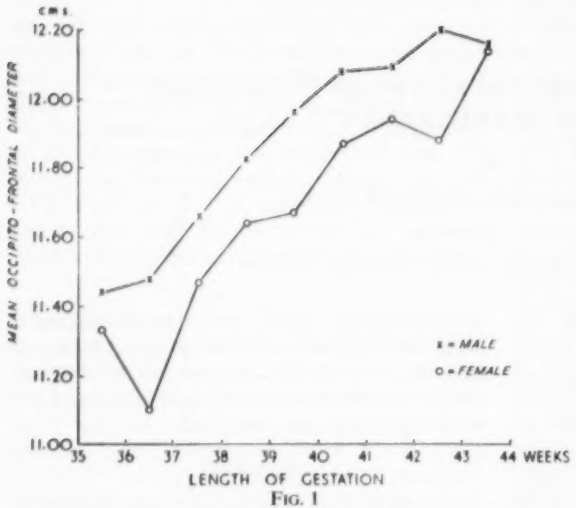

FIG. 1

Mean occipito-frontal diameter for each 7-day period of late pregnancy plotted against length of gestation.

result of surgical induction of labour before the 39th week. The measurement of each diameter in centimetres was plotted against the estimated duration of pregnancy. The mean and the standard deviation for each diameter were calculated for every period of 7 days from the 35th to the 44th weeks of pregnancy inclusive.

(i) *Occipito-Frontal.* Table I gives the data on this diameter for each sex, and Fig. 1 shows the line joining the mean diameters plotted against length of gestation for each sex. It will be seen that there is an over-all increase in this diameter as pregnancy advances from the 35th week. Table I also shows the number of cases contributing to each mean diameter in in every 7-day period.

(ii) *Sub-occipito Bregmatic.* The data for this diameter are shown in Table II and the mean growth line is shown in Fig. 2.

(iii) *Biparietal.* Growth in this diameter for both sexes has been reported previously. Table III and Fig. 3 show the data and growth of this diameter for each sex.

All the measurements made show that from the 35th week of pregnancy there is an increase in the mean diameter. Owing to the small number of cases at the beginning and end of the series, results at each extreme cannot be as reliable as in the intermediate ranges. It is also possible in some of the cases that there may have been a maternal miscalculation of dates which commonly results in an error of approximately 4 weeks on either side of the expected date of delivery.

The three diameters mentioned above were also measured in 24 infants who were born as a result of the induction of labour before the 39th week by dates. The histogram (Fig. 4) shows that, of the 1,059 cases delivered as a result of spontaneous onset of labour, over 80 per cent were born after the end of the 38th week of pregnancy, so that, in the case of those induced before 39 weeks, the chance of the time of their spontaneous delivery coinciding with that of their induction was remote. As will be apparent later, it is necessary to consider this group of induced cases separately before growth

TABLE II

Data on Sub-occipito-bregmatic Diameter in each 7-day Period of Late Pregnancy

Weeks	35–36		36–37		37–38		38–39		39–40	
Sex	M	F	M	F	M	F	M	F	M	F
Mean measurement (cm.)	9.43	9.32	9.46	9.36	9.61	9.46	9.76	9.50	9.83	9.61
Standard deviation	0.43	0.32	0.34	0.45	0.36	0.40	0.37	0.42	0.39	0.36

Weeks	40–41		41–42		42–43		43–44	
Sex	M	F	M	F	M	F	M	F
Mean measurement (cm.)	9.89	9.75	9.95	9.82	10.03	9.84	10.01	9.89
Standard deviation	0.38	0.40	0.42	0.42	0.43	0.40	0.42	0.31

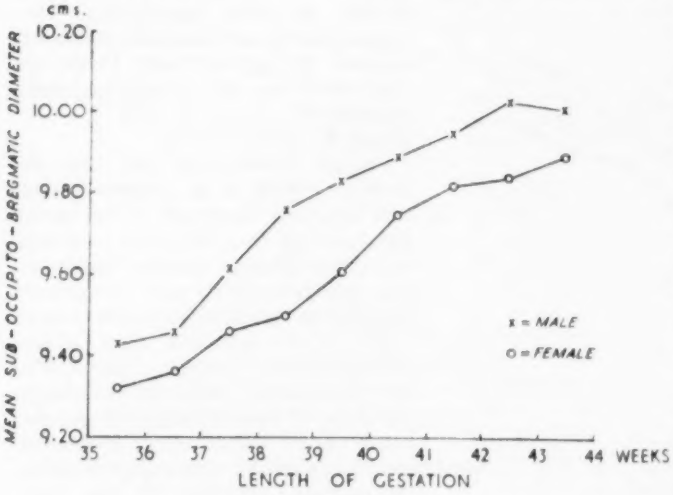

FIG. 2

Mean sub-occipito-bregmatic diameter for each 7-day period of late pregnancy plotted against length of gestation.

of a diameter can be assumed from the remainder of the data.

DISCUSSION

In all the diameters investigated the line joining the mean measurement for each week rises as pregnancy progresses. The analysis of variance test (Ministry of Supply, 1948a) was used to check linearity, and it was found that each set of observations did not depart significantly from a straight line. Though the line of growth rises with the advancement of pregnancy it would not be strictly correct to assume that the difference in measurement between any two selected dates indicated the growth that had taken place between those dates. Precisely similar curves could be obtained if every foetal head stopped growing at a similar period before delivery. However, the head diameter of infants born as a consequence of surgical induction before the 38th week of pregnancy showed no difference from those born spontaneously at comparable weeks.

If the growth of the foetal head stopped in the later weeks of pregnancy, one would expect the dimensions of the induced cases to correspond to those of a date considerably later than that of their induction. The fact that the measurements fall in their appropriate position on the curve makes it a reasonable assumption that no cessation of growth of the head takes place during the few weeks before birth.

It can be seen in Figs. 5 and 6 that the data for at least two-thirds of the surgically induced infants lie within the shaded area which represents the standard deviation of the occipito-frontal and sub-occipito-bregmatic diameters respectively. It has previously been shown that the biparietal diameters of infants born as a consequence of surgical induction do not differ from those born spontaneously (Macdonald, 1952).

TABLE III

Data on Biparietal Diameter in each 7-day Period of Late Pregnancy

Weeks	35–36		36–37		37–38		38–39		39–40	
Sex	M	F	M	F	M	F	M	F	M	F
Mean measurement (cm.)	8.80	8.75	8.92	8.78	9.07	9.01	9.21	9.12	9.33	9.18
Standard deviation	0.36	0.31	0.36	0.26	0.34	0.49	0.35	0.34	0.34	0.34

Weeks	40–41		41–42		42–43		43–44	
Sex	M	F	M	F	M	F	M	F
Mean measurement (cm.)	9.46	9.31	9.50	9.42	9.66	9.45	9.72	9.52
Standard deviation	0.36	0.32	0.34	0.37	0.39	0.35	0.32	0.32

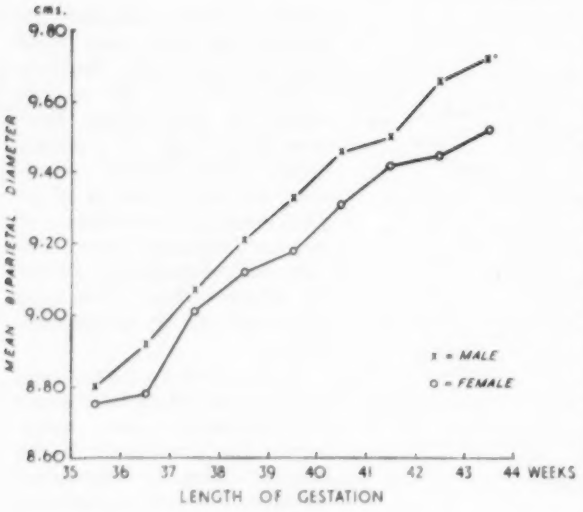

FIG. 3

Mean biparietal diameter for each 7-day period of late pregnancy plotted against length of gestation.

That the rate of growth for any diameter is not altered greatly by the sex of the foetus can be seen from Table IV where the slope of the line for dimensions plotted against duration of pregnancy is given for each diameter. It can be shown by applying Students " t " test (Ministry of Supply, 1948b) to the pair of lines in each diameter that in late pregnancy the rate of growth is unaffected by sex.

In Table IV is also shown the slope of each diameter when the measurements on the two sexes are pooled. From this it can be seen that the rate of growth of the biparietal and occipito-frontal diameters of the head are approximately equal, whereas that of the sub-occipito-bregmatic diameter is slower. This means that the shape of the head is altering during the later weeks of pregnancy, the size of the biparietal diameter gradually approaching, but never equalling, that of the sub-occipito-bregmatic diameter. In other words the biparietal-sub-occipito-bregmatic or normal "engaging " circumference of the foetal head becomes more circular as term approaches. The occipito-frontal and biparietal diameters increase by approximately 1 mm. a week while the sub-occipito-bregmatic increases by about 0.8 mm. a week during the period covered.

Having shown that the rate of absolute growth in the occipito-frontal and biparietal diameters is the same, and knowing that the occipito-frontal is a larger diameter than the biparietal, it is obvious that there must be a greater increase in proportion to the initial length in the biparietal than in the occipito-frontal diameter. Calculating the proportional increase by dividing the slope of the regression line by the mean square within arrays it can be shown (Table IV) that this is so. The proportional increase of the sub-occipito-bregmatic diameter is very similar to that of the occipito-frontal diameter. Of the three diameters measured, therefore, the biparietal shows the greatest proportional increase in the last weeks of intra-uterine life, while the proportional increase in the occipito-frontal

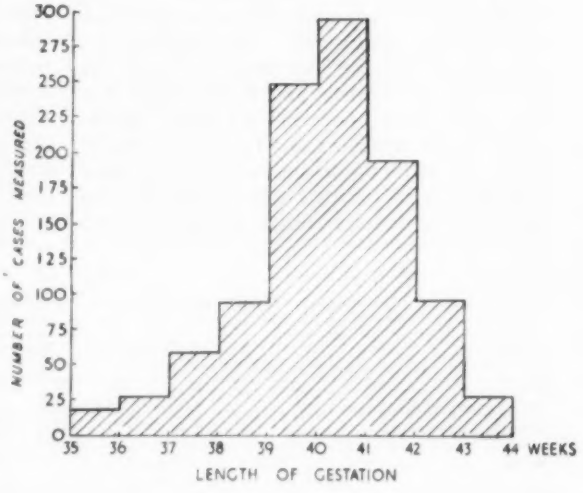

FIG. 4

Histogram showing number of cases measured in each 7-day period of late pregnancy.

TABLE IV

Diameter	Slope of the regression line. Diameter v duration of pregnancy		Mean male diameter minus mean female diameter in cm.	Slope of regression line from pooled data	Increase in cm. per week for every cm. of diameter
	Male	Female			
Occipito-frontal ...	0.101	0.111	0.21	0.106	0.0089
Sub-occipito-bregmatic	0.077	0.085	0.17	0.081	0.0083
Biparietal	0.113	0.101	0.13	0.107	0.0115

and sub-occipito-bregmatic diameters is very similar.

Students "t" test showed that there was a significant difference between the male and female lines representing growth in the diameters measured. The calculated difference in each diameter associated with the sex of the foetus is shown in Table IV. It can be seen that these findings are in accord with previous observations that the head of the male infant is larger than that of the female.

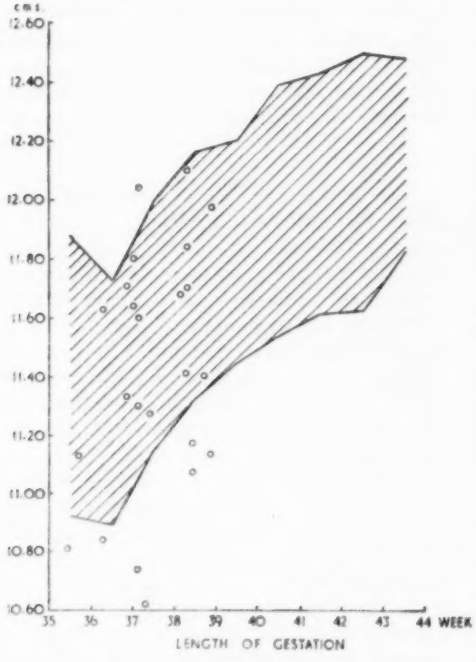

FIG. 5

Standard deviation of occipito-frontal diameter (shaded area) plotted against length of gestation. The circles represent the occipito-frontal diameters of infants born after surgical induction.

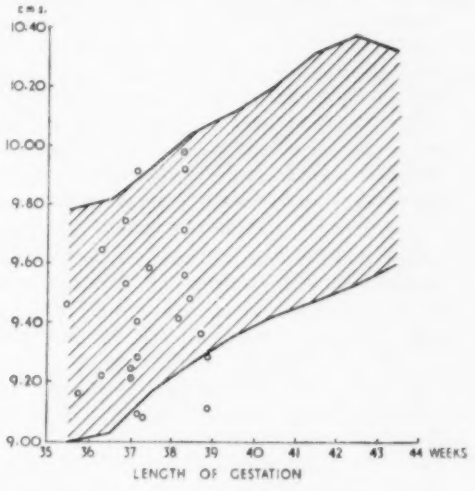

FIG. 6

Standard deviation of sub-occipito-bregmatic diameter (shaded area) plotted against length of gestation. The circles represent the sub-occipito-bregmatic diameters of infants born after surgical induction.

SUMMARY

(1) The occipito-frontal, sub-occipito-bregmatic and biparietal diameters of 1,083 infants were measured 48 to 96 hours after delivery.

(2) It is shown that growth occurs in each of these diameters of the head in the last weeks of pregnancy.

(3) Size of the foetal head, but not its rate of growth, is influenced in late pregnancy by the sex of the foetus.

I wish to thank Mr. P. Armitage of the Medical Research Council, Statistical Research Unit, for his help. Part of this work was done during the tenure of a Leverhulme Research Scholarship awarded by the Royal College of Obstetricians and Gynaecologists.

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THE MALE FACTOR IN HUMAN STERILITY*

BY

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SINCE 1742, when van Leeuwenhoek first observed the movement of ram spermatozoa under the microscope, the problem of fertilization has excited much interest and greater speculation. Only in the last decade have our beliefs come to rest on a sound basis of physiology and biochemistry. Much of this recent work does not appear to be generally known —old beliefs die hard; for example Mann and Lutwak-Mann (1951) note that " It has required much scientific effort to overthrow the firmly entrenched conviction, in some quarters, that the vesicula seminalis is a burial ground for aged spermatozoa, but on the contrary, that it is a gland endowed with a characteristic secretory function."

Sperm Production

Semen, as ejaculated, consists of sperm suspended in a fluid, the seminal plasma. Spermatozoa are formed in the seminiferous tubules of the testes and stored in the epididymis. During their passage along the epididymis a progressive maturation takes place, during which they develop entirely different methods of metabolism and respiration, the latter changing from cytochromic to glycolytic (Henle and Zittle, 1942). The fertilizing capacity of ejaculate sperm is greater than epididymal sperm. In animals this passage takes 7 to 14 days, and in the human about 4 to 5 days.

The formation of sperm in the rat has been found to occur in waves (Roosen-Runge and Giesel, 1950). The duration of each wave is 4 days, whilst spermatogonial mitosis is less than 48 minutes. The complete cycle from spermatogonia to spermatozoa is 16 days. Whilst we have no direct evidence in men, deductions can be made from evidence of a different kind. Thus Farris (1950a, b) took volunteers, one of whom produced a daily masturbation specimen for 21 days, whilst others produced specimens at 2, 3 and 4 day intervals. Farris found there was a rapid and persistent fall in sperm production when the daily specimens were produced, which slowly improved as the intervals increased, the optimal interval being 5 days. This would suggest a spermatogenetic wave of 4 to 5 days being required for maturation in men.

Whilst there is no certain method of increasing spermatogenesis in men (although Roosen-Runge (1951) has done so in rats by the use of colchicine), the administration of methyl testosterone has been shown recently to improve sperm density in oligospermic men. As at first there is a total inhibition of spermatogenesis, followed by an increase when the treatment is stopped, it is doubtful whether this " rebound " phenomenon, as it is described by Heller *et al.* (1950), is really a true increase. It may be rather merely the result of an accumulation of delayed mitoses, for the patients seem to relapse later to their usual oligospermia. On the other hand, prolonged abstinence produces diminished fertility, possibly due to sperm degeneration.

Harrison (1949), using a fine thermocouple enclosed in a needle, has been able to show that there is a constant species temperature difference between the abdomen and testicles, varying from 2° in man and monkey, to as much as 8.4° in the ram, and that spermatogenesis is sensitive to a rise rather than a fall in temperature. The application of ice to the ram's testes (Chang, 1943), whilst not reducing the numbers, produced morphological abnormalities.

This lowered temperature of the testes is brought about, not only by the mechanism of

* Part of an address to the Pathological Section of the Manchester Medical Society on 12th December, 1951.

the dartos muscle, described by Lillie many years ago, but also by the complex arrangement of the testicular artery in mammals, which convolutes to a variable extent before reaching the testes, and is closely surrounded by veins of the pampiniform plexus. Experimental evidence shows that this relation to veins and arteries is well adapted for pre-heating or pre-cooling the arterial blood flow. Furthermore, the blood flow in the testicular artery is reduced by a variety of devices in different species, which increases heat loss from the testes. The clinical significance of the need for a constant testicular temperature lower than that of the rest of the body is shown by the fact that ectopic or cryptorchid testes in the adult are almost always atrophic, no doubt the result of prolonged contact with the higher temperature of the body. This is confirmed by the experiments of Lacassagne and Raynaud (1937), who found that when the ram's testes were placed in the abdomen spermatogenesis ceased, but would return on replacing the testes in the scrotum, provided the interval were not too long. After a certain critical time regeneration of spermatogenesis became impossible.

It is interesting to note that the Japanese believe that very hot baths are a good contraceptive, although this has not been put to a scientific test. It is significant that many professional athletes have been noted as patients in sterility clinics—and the regular use of a jock strap, so common in such people, by heating the testes may be a factor in their reduced spermatogenesis.

A further clinical application is the danger that the testicular artery, which is an end-artery, may be ligatured during operations on the cryptorchid—its ligature would, of course, cause incurable atrophy, and I have seen a number of cases of this nature.

Biopsy

Our knowledge of spermatogenesis has been considerably advanced by the introduction of biopsy by Charney in 1940, and Hotchkiss in 1944. The method is the excision under anaesthesia, local or general, of a portion of the testis, and more recently by the method of punch biopsy.

A tiny portion of the tissue is removed from each testis, and no harmful effects have been seen. The tissue is fixed in Bouin's fluid, to which a little urea has been added. The function of the test is first to help in diagnosis, secondly to decide the prognosis, and thirdly to decide whether any treatment is worth while. A great deal of time and money is wasted in treatment of the male in certain conditions which do not respond to any known treatment, according to our present knowledge. In azoospermia, biopsy will decide whether the failure is primarily in the testes or primarily in the pituitary gland, also whether there is duct obstruction due to disease or congenital atresia. This latter condition was unknown in this country until attention was first drawn to it by Young in 1948. I described the second case (1950), in which the biopsy also shows normal spermatogenesis. When biopsy is used in conjunction with hormone assay and semen analysis, a great deal of light can be thrown on the nature of the conditions and possible treatment.

Normal Testis

The normal testis is divided into tubules consisting of basement membrane and tunica propria. On the basement membrane rests a single row of spermatogonia. The oval or fusiform nuclei of Sertoli cells are just above the row of spermatogonia. These are the only oval nuclei in the section. The primary spermatocytes have the largest nuclei, round, vesicular and clearly visible chromatin network, often in active mitosis. Above the primary spermatocytes, near the border of the lumen, are very small nuclei of spermatozoa embedded in the cytoplasm of Sertoli cells. The latter are like the spokes of a wheel, and their function was thought to be part of the sustentacular structure of the tubules. Evidence from widely different sources, particularly the work of Gunnar Teilum (1949, 1950, 1951) on the lipoid content of androblastomata, suggests that the Sertoli cells are oestrogen-secreting cells, which nourish sperm embedded in their cytoplasm. The sperm complete their maturation in the Sertoli cytoplasm, which is vague in outline and faintly acidophil. Cell membrane is distinguishable only at the base of

the cell—at the apex it is diffuse where spermatozoa are released.

Another portion of the tubules may show secondary spermatocytes and spermatids, recognizable by the small dark nuclei arranged in rows. It is significant that not all stages from spermatogonia to spermatozoa are seen in one tubule, suggesting the existence of the spermatogenic wave described earlier.

Arrest of spermatogenesis (Fig. 4) may occur at any one of these stages, or even at the stage before spermatogonia are formed. In this latter case only Sertoli cells will be seen, arranged like spokes of a wheel. Outside the tubules are Leydig cells, which may be diminished or increased as will be described later.

Leydig cells are found singly or in small groups. They are usually ovoid or polyhedral, with large vesicular eccentric nuclei and with 1 or 2 nucleoli. Chromatin material is present as diffuse granular masses located around the periphery of the nucleus. The cytoplasm contains crystalloids and pigment granules, also refractile granules when the frozen section is examined, which are regarded by Heller as indicative of the degree of functional health.

There are 6 main conditions which may be recognized histologically by biopsy.

(1) *Eunuchoidism.* This is rare and, even in the wealth of material available in American endocrinological clinics, Howard *et al.* (1951) saw only 4 cases in 119 complaining of sterility. There is a history of impotence, the general physical appearance of eunuchoidism, and occasionally gynaecomastia. There is, of course, azoospermia and a very low secretion of FSH and 17-ketosteroids. Biopsy will show infantile or regressing tubules and an absence of Leydig cells. This type of case may respond to treatment with FSH, according to Howard *et al.* (1950) and Werner (1951), who each report the successful establishment of spermatogenesis in 1 case.

(2) *Hypospermatogenesis* (Fig. 1). The lesion is confined to the germinal epithelium. All cells are reduced in number, particularly the spermatogonia. It can occur after a severe illness, and after the administration of oestrogen for other conditions, such as cancer of the prostate, or there may be no previous medical history. FSH excretion is normal and biopsy otherwise normal. Since the tubules show scarcity of all germ cells, some may show spermatogonia but decreasing numbers of spermatocytes and spermatids. Rarely there may be spontaneous improvement, but no treatment is of certain value, according to our present knowledge. There is usually oligospermia, and occasionally azoospermia. Some degree of hypospermatogenesis may also be seen when there is duct obstruction, but quite often then the appearances are normal.

(3) *Germinal Aplasia.* The tubules are reduced in size, and there is complete absence of spermatogonia. Basement membrane and tunica propria are not thickened or hyalinized. The contour of the tubules is regular and not wrinkled (Fig. 2) as in progressive fibrosis. The Sertoli cytoplasm shows fine and coarse granulation with wavy fibrils. The absence of evidence of inflammation suggests a primary congenital condition. Leydig cells are normal, the men are potent, sex development is normal, FSH excretion is high and the 17-ketosteroids sometimes low. The aetiology is unknown, and treatment impossible. Similar appearances are seen after exposure of the testes to X-rays, and in victims of the atom bomb explosion at Hiroshima. There is an incurable azoospermia.

(4) *Progressive tubular fibrosis,* or sclerosing tubular degeneration. This condition is not comparable to the atrophy of senility, irradiation damage or mumps orchitis, because of the Leydig hyperplasia. The tunica propria shows increased thickness (Fig. 3) due to lamination and hyalinization of the collagenous fibres. The basement membrane is thickened to a lesser degree, and the condition progresses so that the lumen is reduced in size or even disappears. There may be only Sertoli cells left, but occasionally tubules may show all stages of spermatogenesis, but in a few cells only. The condition is usually found in men of the age group 30 to 40. There is no previous medical history, and no known cause. The process is irreversible and cannot be arrested. FSH excretion is high, and there is no change in libido or body appearance. Infantile tubules and undifferentiated epithelium may be found, suggesting that the condition starts in puberty. It is usually associated with

oligospermia, which finally progresses to azoospermia.

It is particularly stressed that the condition of progressive tubal degeneration is not amenable to treatment, according to present knowledge, and the best hope lies in seeing these cases early, for in a case described below, a year after being first seen, the oligospermia had progressed, so that the sperm count was now reduced to 250,000 per ml. It is a sad fact that years are wasted because so many childless couples are advised to wait 3 years before investigation is begun. If that advice had been taken in this case, I am satisfied that the husband would by then have had a total azoospermia.

Hemphill, Reiss and Taylor (1944) have drawn attention to the occurrence in schizophrenia, but not in other mental diseases, of a condition very similar to the one already described. There is a hyaline degeneration of the basement membrane, associated with atrophy of the germinal epithelium, in most cases indistinguishable from the progressive degeneration described above. They bring forward evidence to show that vascular sclerosis is the probable cause, and suggest that the hyalinization is the cause and not the result of the failure of spermatogenesis.

In castrated sex criminals Sand and Okkels (1936) found similar tubular hyalinization associated with thickened basement membrane. Sex offences are usually the result of mental disorders, schizophrenic conditions commonly being associated. Furthermore, Hemphill, Reiss and Taylor (1944) note that extensive tubular degeneration and hyalinization occurred in a case of hypothalamic tumour. All these facts suggest that the hypothalamus is the controlling influence of these conditions. In support of this conclusion is the well-known fact that hypothalamic lesions are concerned with loss of emotional control and sexual disability, and I have one case of narcolepsy, associated with oligospermia, in whom there is the distressing condition that laughter or other emotional disturbances cause total collapse with seminal emission.

(5) *Spermatogenic arrest* (Fig. 4). This was first described by Engle in 1942, in a case of sudden death by street accident. The tubules are of normal size, and the Sertoli cells not atrophic. The cytoplasm contains normal fat droplets, the basement membrane is delicate and there is no thickening of tunica propria. Arrest of development may occur at any stage of spermatogenesis, but usually progresses as far as the primary spermatocytes, but no farther. The constancy of the point of arrest in a tubule is in marked contrast to the variability seen in hypospermatogenesis, although this testis is similar to the appearance of the hypophysectomized rat testis described by Smith in 1939. FSH is usually normal in man. Although the administration of FSH in the rats repaired the damage, its administration had no effect in man. All the three last conditions described may be accompanied by azoospermia, but the mechanism is probably different in each type.

(6) *Duct obstruction.* Azoospermia must always be investigated and the absence of fructose indicates the obstruction is blocking the vesicles. The discovery of fructose in semen by Mann (1948) was of great importance, the clinical significance of which, as a differentiating test in duct obstruction, was first realized by Young of Warrington. In the U.S.A. Howard, Simmons and Sniffen (1951) found duct obstruction in 33 cases of azoospermia out of 109 biopsies. Of these 19 were due to gonorrhoea, 1 to tuberculosis, and 5 to aplasia. These figures for gonorrhoeal obstruction are much higher that those I have encountered, which is approximately 2 per cent, a similar figure being reported by Sharman (1944). The explanation may well lie in the differences in social environment. The presence of normal testicular histology and azoospermia is an indication for surgical exploration which may, in the hands of an expert (Bayle, 1950), have a success rate of 50 per cent, or more in the case of gonorrhoea. In congenital defects there may be complete absence of the duct associated with other deficiencies of the testis itself, and the prognosis is more doubtful.

Seminal Plasma

At ejaculation the sperm receive complementary secretions from the accessory organs of reproduction, which together constitute seminal plasma and provide the vehicle for the sperm. In respect of their nutrient requirements, sperm

resemble more a culture of micro-organisms in a nutrient medium, rather than other animal tissues which receive their supply of nutrients through the blood.

The composition of the fluid ejaculate will vary according to the contribution of the epididymis and of each accessory secretion, Lundquist (1949) estimating that prostatic secretion contributes 12 to 32 per cent, and the vesicles 46 to 80 per cent. The components of semen are not discharged simultaneously but follow in a definite order, as proved in certain animals such as the boar and the stallion, where copulation lasts a considerable time with a large ejaculate, and in men by the split ejaculate method (Lundquist, 1949). In man the first secretion is from Cowper's gland, then follow prostatic secretion, spermatozoa, and lastly vesicular secretion. Occasional cases of azoospermia are due to the fact that a nervous patient may only collect a portion of the secretion containing no spermatozoa. MacLeod and Hotchkiss (1942) have shown that 75 per cent of the sperm are contained in the first 40 per cent of the ejaculate. Oligospermia may also be wrongly diagnosed, therefore, if the whole ejaculate is not collected. The clue to this mishap is that severe oligospermia is usually accompanied by defects in morphology and viability, which will be absent in a case where all the specimen has not been collected.

In view of the above, the well-known variation of semen quality from day to day in the same individual should cause no more surprise than a similar variation in, say, a mixture of tears and saliva. Yet there are still laboratories willing to pronounce a diagnosis of infertility based on one specimen only.

Semen Analysis

This should be done in a laboratory with special experience of this work, and where one tactful technician may interview the man in complete privacy, so that he may be made to understand how the specimen is to be obtained. It is important to see the man, and not just the semen. The usual busy pathological laboratory, with female assistants about the place, is usually quite unsuitable. Because of the great variations in normal semen from day to day, no man should be condemned on one semen analysis only. The method of collection is important. Necrospermia is usually caused by the container, for example the rubber in the condom, or metal in the lid of the vessel. Chilling may also cause apparent death, as will be described. True necrospermia is hardly ever seen, and a second masturbation or withdrawal specimen will usually prove normal. Even then there are difficulties—one case of apparent azoospermia in a withdrawal specimen was eventually explained by the fact that the ejaculate did not enter the collecting jar, and the specimen was deposited in the bed, from which it was subsequently collected by the patient. It was probably a specimen of pure prostatic secretion.

In another case, severe oligospermia had been diagnosed elsewhere, and the man was pronounced sterile, but no one had discovered from the man that this specimen had taken 45 minutes to produce, by which time he was a physical and psychological wreck. It must also be realized that reflex inhibition may occur and, as a result, azoospermia can occur, as evidenced in both withdrawal and/or masturbation specimens, yet nocturnal emissions may be normal.

The interval of abstinence is also important. In one case an extremely small and oligospermic specimen provided, with difficulty, by masturbation, puzzled the patient, who complained that he could not understand it, as he had been all right when having intercourse a few hours before! Usually 4 or 5 days abstinence is advised, longer intervals being undesirable.

The examination must include not only the sperm density and total volume of the ejaculate, but also data on the liquefaction, viability, motility, percentage of abnormal cells present, fructose, citric acid content, and bacteriology. The methods are fully described in two recent textbooks by Lane-Roberts *et al.* (1948), and by Margaret Jackson *et al.* (1948). Many fallacies can occur from faulty technique and the methods described must be followed accurately, failure to mix the semen adequately being the commonest fault.

Standards of Semen Quality

Even assuming that the semen analysis alone is a sufficient criterion of fertility, comparisons

are difficult because of the incomplete data presented in different laboratories. Indeed, in some quarters, fertility is defined in terms of sperm density alone, whilst others are satisfied if sperm are seen moving under the microscope, no actual count being done at all. Still greater confusion exists as to what is the minimal standard for fertility, and the function such a standard should perform.

In other spheres of biological investigation departure from the standards laid down, be it blood chemistry, urinalysis, or other estimation, must imply the presence of disorder in the person being investigated, but in a case of sterility a subnormal report may well throw the emphasis on the wrong partner in the marriage.

In animal husbandry, the breeder mates one male with a large number of females. A minimal standard of semen quality serves a reasonable purpose for him, since it enables him to predict the pregnancy rate to be expected from a particular animal mated with a given herd. But in human sterility our requirements are different—we require to know the fertility of a man in relation to one particular woman only. In adopting the methods of animal breeders we have lost sight of the fact that our standards are required for a different purpose—while they are assessing a stud animal, we should be assessing a marriage. Unless, therefore, semen quality is related to the fecundity of the wife, the semen analysis alone may be not only meaningless but grossly misleading.

The following case illustrates the numerous fallacies which can occur when semen alone is held responsible for the sterility.

The husband was aged 36. Necrospermia had been diagnosed elsewhere but in fact was caused by the use of a condom. A repeat specimen showed volume 3 ml., 2,400,000 per ml., 68 per cent abnormal forms, 50 per cent dead within the first hour, 66 per cent dead in 4 hours. Hormone assay and testicular biopsy confirmed primary testicular failure, with only a few areas showing spermatogenesis.

The wife, aged 20, had no previous medical history. The cervix was red and inflamed, but normal in size and shape. The post-coital test was negative, gas insufflation showed tubal spasm, but salpingography revealed patency. Cervical culture revealed *Bacterium coli* and staphylococcus, coagulase-negative. She was treated with penicillin, sulphatriad and short-wave pelvic diathermy, after which the cervical culture became sterile, and the patient was found to be pregnant. Yet on the basis of one semen analysis the husband previously had been given a hopeless prognosis.

The original standards laid down by Moench (1933) were that there should be less than 20 per cent abnormal heads in fertile semen, whilst Meaker (1934) has said that "a man is incapable of reproduction if the count is less than 60,000,000 per ml." Macomber and Saunders (1929) give the same figures, whilst even in 1950 the American Society for the Study of Sterility issued to its constituent laboratories standards which give 40,000,000 per ml. as the lower limit. These standards are certainly not true in the light of present-day knowledge, and are even flatly contradicted by many authors. The reason for this discrepancy is that the earlier authors based their figures on childless couples seeking treatment, who were not representative of the average normal population. Only by an examination of many men, already fathers, and who are not seeking advice regarding their ability to procreate, can reliable information be obtained.

Davidson (1949) examined a few such volunteers and arrived at the following standards of normality: volume 1.5 ml.; density 40,000,000 per ml.; basic motility 40–50 per cent; morphology, total abnormal forms not to exceed 40 per cent, of which abnormal heads should not exceed 25 per cent; viability, the motility of the 5-hour count should not be less than half the basic motility; leucocytes and other cells should not exceed 2,000,000 per ml. MacLeod and Gold (1951) collected 1,000 such volunteers and they take as standard that density above which 95 per cent of fertile men are found. This places the minimal standard at 20,000,000 per ml., 40 per cent basic motility, and not more than 40 per cent abnormal morphology.

It is clear that in an average population there must be many men with semen content hitherto regarded as subfertile, according to textbook standards who, being married to a fertile wife, remain blissfully unaware of their theoretical disability, and produce families just the same!

A man who had already 1 child, developed mumps orchitis, followed by 2 years azoospermia. Spermato-

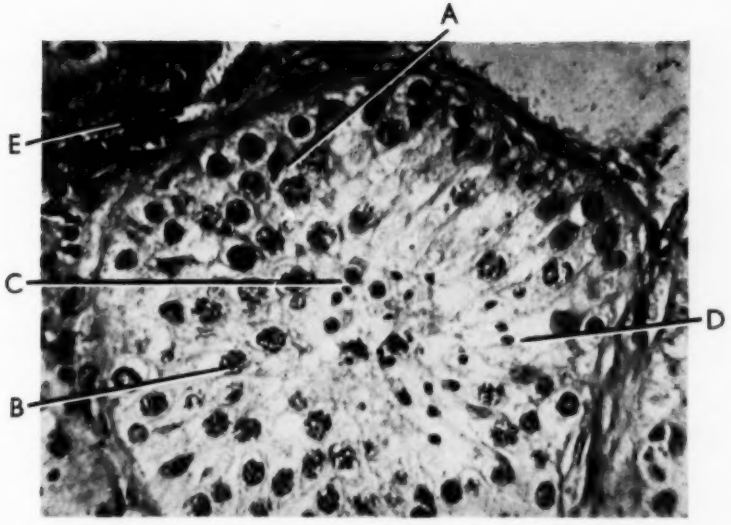

FIG. 1

Transverse section of tubule in hypospermatogenesis showing reduction in all types of cells, especially spermatogonia, but spermatozoa are present—from a case of oligospermia.

A. Nucleus of Sertoli cells.
B. Spermatocyte.
C. Spermatid.
D. Spermatozoa.
E. Leydig cells (some degree of hyperplasia).

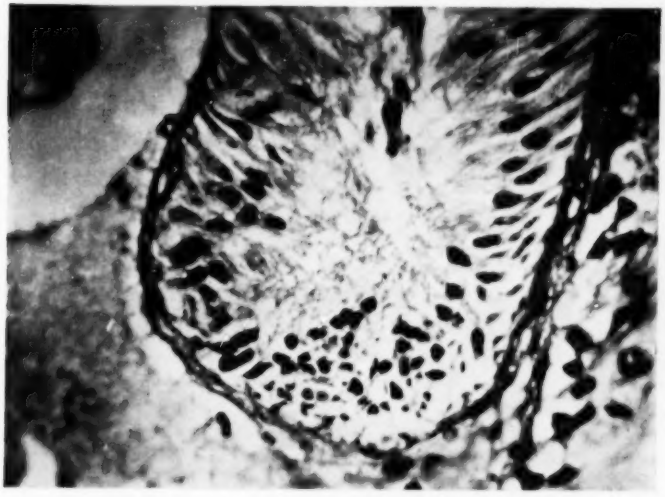

FIG. 2

Germinal aplasia—oblique longitudinal section showing nuclei of Sertoli cells only—cut at various angles—no spermatogenesis present—a case of azoospermia. Note regular contour of basement membrane—granulation and fibrillation of Sertoli cytoplasm.

B.S.

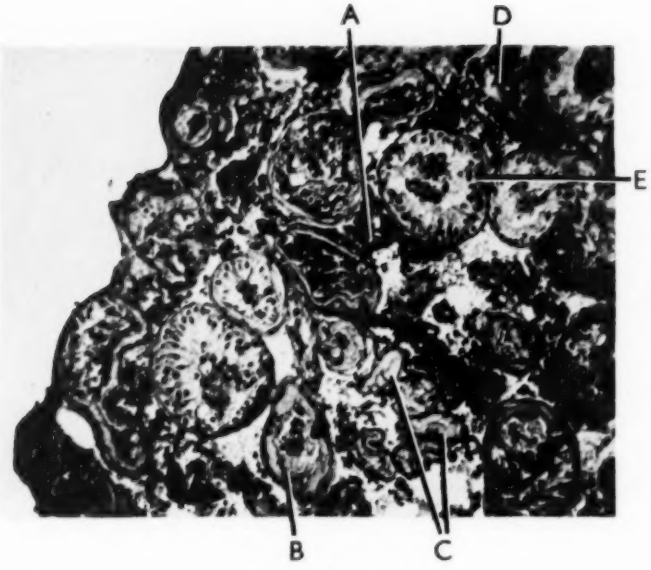

FIG. 3
Progressive tubular atrophy.

A. Leydig cell hyperplasia.
B. Hyalinization, thickening and wrinkling of basement membrane, with shrinkage of cell lumen.
C. Total obliteration of lumen.
D. Peritubular fibrosis.
E. Reduction of spermatogenesis to almost complete atrophy.

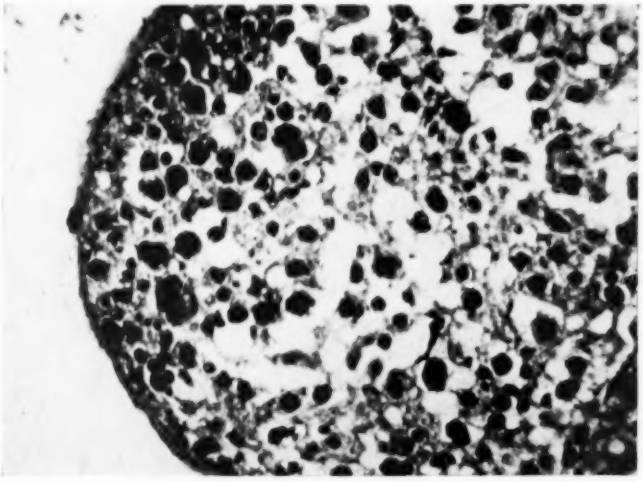

FIG. 4
Arrest of spermatogenesis at spermatid stage—case of azoospermia.

genesis slowly became re-established without any treatment, and he achieved a pregnancy when his maximal sperm density was not higher than 50,000 per ml.

Conversely, a high sperm density is not of itself an adequate index of fertility, as the following case shows.

A wife, aged 28, was sterile for 6 years, during which time she had two operations under anaesthesia at different hospitals, probably insufflations. Only then was the semen examined and reported normal at a third hospital. No figures were available, and no post-coital tests were done. When first seen by me the post-coital test showed all spermatozoa dead. The husband, aged 35, then had a semen analysis as follows: volume 2 ml. with 120,000,000 per ml., 30 per cent abnormal forms present, 100 per cent dead within 2 hours. This was clearly a case of poor viability, although all other factors were normal. Culture of the cervical mucus revealed the presence of a coagulase-positive staphylococcus, treatment of which was followed immediately by pregnancy.

In this case the high sperm density, without investigation of other factors, had been grossly misleading, suggesting normality. One must deplore the method of investigation previously adopted, which involved operations on the wife before a semen analysis or post-coital test was undertaken.

Morphology

Engle has said (personal communication) that pregnancy cannot occur with the abnormal sperm count as high as 65 per cent. In my experience pregnancies have been obtained when the individual percentage abnormal counts have been as high as 82, 90, 63, 62, 90, and 75. In all these cases the husband did not receive any treatment; only the wife's cervical mucus was treated. In this connexion I have mentioned that Chang (1943) has shown that the application of ice to the testes in animals will produce abnormal sperm, but in 1946 he also showed that the fertilizing capacity of such a treated sample was not lowered, even after the sample contained 90 per cent abnormal sperm, provided that there were sufficient numbers of morphologically normal sperm present. This is important as indicating that the infertility in a particular case may not be due to the high abnormal count, but rather to the paucity of normal sperm remaining as a result. The significance of this in relation to mucus hostility will be discussed later.

Viability

Pregnancies have occurred with the following high percentage rates of initial sperm death: 90, 89 and 94. The case described previously had 100 per cent dead in 2 hours, 62 per cent when specimen was passed.

Temperature shock is an important phenomenon of which account must be taken in performing viability tests. This condition is the rapid immobilization of sperm which results from sudden cooling of semen to 5°C. or 10°C. (Chang and Walton, 1940). This contrasts with the fact that sperm can survive in semen that is frozen quickly to −79°C. to −185°C., and subsequently thawed quickly. This method is already being considered for animal husbandry work, and offers great possibilities for the preservation of sperm.

Cervical Mucus Hostility

It is now widely recognized that there is a definite condition in which there is hostility of the cervical mucus to the entry of sperm, even when the sperm are apparently normal. How much more so must this be the case when the semen is subfertile. Even with fertile semen it is known that only a small percentage of sperm penetrate the mucus, and of these only one penetrates the ovum.

How then are the relative factors of mucus hostility and male subfertility to be assessed? For we do not know what permutations of fertility and subfertility exist among the partners of a marriage, and certainly not what happens when subfertility is present in both partners. As already stated, a rigid standard for semen quality can be most misleading. We must seek a method of assessment of the one partner in relation to the other, and clearly this must be based on the post-coital test devised by Sims (1868).

Subfertile Semen

There is considerable evidence that, whilst sterility may ensue when both partners are subfertile, nevertheless increasing the fertility of one

may compensate for the other's disability, so that pregnancy can occur. We have, for example, such evidence from cases of divorcées who have married the opposite partners and have become pregnant, although previous marriages were sterile. Hammen (1944) described a case of a subfertile man, aged 36, married 11 years to a wife in good health, but there were no pregnancies. In 1941, this man was responsible for an extra-marital pregnancy after 2 months cohabitation, and again in 1942 another extra-marital pregnancy occurred immediately after ceasing contraception. In another case of my own, the wife, sterile for 11 years, had a history of occasional anovulatory cycles, accompanied by amenorrhoea. She was married to a man aged 35, with the following semen analysis: volume, 6.4 ml., liquified 20 minutes, total count 64,310,000 per ml., 74 per cent dead, 88 per cent abnormal forms. After 6 years of marriage she had one extra-marital coitus whilst abroad, and became pregnant at once. A further 3 years cohabitation with her husband has not produced a pregnancy, although there is no organic impediment other than the occasional amenorrhoea and anovulation. Investigation so far carried out has revealed a cervical mucus not receptive to her husband's sperm, although it is receptive to fertile sperm by invasion test.

These and many other similar cases have convinced me that the high fertility of one partner can compensate for the subfertility of the other. I have previously mentioned cases which showed that even severe oligospermia, poor viability and highly abnormal morphology are not necessarily a bar to conception when the wife becomes normal. MacLeod and Gold's findings (1951), in their analysis of 1,000 normal fathers not seeking advice for sterility purposes, also confirm this.

Post-coital Test and Invasion Test

Without this test, and the extension of it, described by Barton and Wiesner (1945) as " the invasion test," no investigation of sterility can be considered complete. Nevertheless, this test must be performed with a clear understanding of the physiology involved. In doing a post-coital test, the superficial portions of the mucus may show many dead spermatozoa, but mucus removed by suction from the deeper parts of the cervix will show normal motility. The use of a platinum wire or spoon for the removal of such specimens may, therefore, give misleading results, if it fails to obtain mucus from the deep endocervix, as may easily happen when such mucus is tenacious. It is better to obtain specimens by some simple suction apparatus which will remove the whole cervical plug, or by forceps. The patient should have been told to have intercourse the night before and, unless there are special reasons to indicate poor sperm viability, a 12-hour interval between coitus and examination is not detrimental to the test. Consequently, the clinic must be run on an appointments system, so that patients can arrange to come at a particular time and day. A post-coital test done in the pre- or post-menstrual phases may be most misleading, and the test should only be done in the ovulatory phase.

I have reported elsewhere (Sandler, 1952) my findings which showed that a negative Sims test was found in 150 of 190 consecutive cases of sterility examined (79 per cent), and pathogenic bacteria were recovered in 15 per cent of these cases.

Where the mucus is absent, scanty or otherwise abnormal, this may prevent conception, irrespective of semen quality. Where the semen is subfertile, correction of the cervical mucus will often permit conception to occur without any treatment to the male. The factors concerned with cervical mucus abnormalities are outside the scope of this paper, but are dealt with elsewhere (Sandler, 1952).

Conclusions

(1) There is no effective specific treatment for most cases of male sterility yet available. Early investigation of both partners should be undertaken as soon as patients request it. This would reveal those early cases of progressive tubular atrophy at a stage before azoospermia has occurred, and when treatment of the wife's hostile cervical mucus will enable conception to occur.

(2) In azoospermia, biopsy may reveal duct atresia, of which cases a certain proportion may

be cured by operation. In the majority of cases, a testicular condition will be found for which no treatment is possible, which will, at least, save considerable time and expense for the patient. It is freely admitted that biopsy is of negative value clinically, but is still important from the research point of view.

(3) The semen analysis is important, but is not, by itself a complete criterion of male fertility. This can only be assessed by the post-coital test, and no assessment of male fertility is complete without it.

(4) There is no apparent connexion between the biopsy appearances and semen analysis or hormone assay, and we have little information as to the correlation of these three factors, except that where gonadotrophic hormone secretion is high there is always tubular atrophy, indicating primary gonadal failure. A parallel condition, of course, exists in castrated women.

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KYPHOSCOLIOSIS COMPLICATING PREGNANCY*

BY

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THE varieties of pelvic deformity which are associated with kyphosis and kyphoscoliosis have long been recognized; accurate descriptions of them may be found in all the older textbooks. The serious cardiac and respiratory embarrassment, however, which may complicate this type of case has received scant attention in this country, although it has long been recognized in France, Germany, and Scandinavia. The first reference to this subject was made by Mauriceau in 1727, and in recent years the subject has been considered fully by Klaften (1927) and Holmgren (1936). In America Jensen (1938) and Hamilton and Thomson (1941) have dealt with it as part of the general problem of heart disease complicating pregnancy, and Chapman, Dill and Graybiel (1939) have described the production of heart failure in cases of kyphoscoliosis among the general population.

In this paper 4 patients will be considered who were seen in St. Mary's Hospitals, Manchester, over a period of 6 years, during which time they were delivered of 9 children. Their case histories will be briefly presented and will be discussed in relation to the general problem of pregnancy complicated by severe angulation of the spine.

CASE 1

Mrs. M. J. (Fig. 1) was 4 feet 5 inches in height with a marked dorsal kyphoscoliosis. There was no evidence of pelvic contraction either clinically or on X-ray examination, although there was an increased inclination of the pelvic brim.

In her first pregnancy in 1946 she had a normal delivery of a small child, 3 pounds 5 ounces in weight. In 1947 she became pregnant again, and had a normal delivery of a baby of 6¼ pounds.

In 1949 she had her third baby, weighing 6 pounds 9 ounces, by forceps extraction for prolapse of the cord at full dilatation of the cervix, and, in 1951, her fourth baby, 6 pounds 13 ounces, was born normally without difficulty. All children are alive and well.

CASE 2

Mrs. V. L. (Fig. 2) was a tiny patient, only 4 feet in height, with marked kyphosis in the dorsal region. There was no evidence of significant pelvic contraction. There was very steep inclination of the pelvic brim which, however, did not prevent engagement of the head at term (Fig. 6).

In her first pregnancy in 1949 she was delivered at term of a child weighing 5 pounds 2 ounces by low forceps extraction, after a short, easy labour. The pregnancy was complicated by a mild hypertension necessitating a short rest in hospital before delivery. In 1950 her second pregnancy was complicated by more severe hypertension necessitating premature induction of labour. She was delivered normally of a child 3 pounds 12½ ounces in weight. Both children are well.

CASE 3

Mrs. M. P. (Fig. 3), had angular kyphosis in the lumbar region. She was only 4 feet 5 inches in height, but was of better muscular development than the other patients. The pelvis showed no evidence of contraction either of the brim or of the outlet. The inclination of the pelvic brim was reduced, (Fig. 5).

In her first pregnancy in 1950 the patient was delivered normally, with the help of an episiotomy, of a baby 5 pounds 15 ounces in weight, face to pubis. In 1951 she was delivered spontaneously at term of her second child, 7 pounds 2 ounces in weight. Both children are well.

CASE 4

Mrs. M. S. (Fig. 4) had one miscarriage at 18 weeks in 1949. She was only 4 feet 4½ inches in height, of poor muscular development, and with gross kyphoscoliosis in the dorsal region. Neither clinically nor radiologically was there any evidence of significant pelvic contraction.

The early months of her second pregnancy in 1950 were complicated by hypertension of the order 150/100 mm. Hg. At the 32nd week of pregnancy she was admitted with a history of having twisted her back, which produced pain between the scapulae.

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FIG. 1

Case 1. Mrs. M.J.
Showing marked dorsal kyphoscoliosis. The pendulous abdomen is well seen although the patient was not pregnant at the time of this photograph.

FIG. 2

Case 2. Mrs. V.L.
A tiny patient, only 4 feet in height, with dorsal kyphosis.

FIG. 3

Case 3. Mrs. M.P.
Showing lumbar kyphosis. Muscular development here was much better than in the other cases.

FIG. 4

Case 4. Mrs. M.S.
Showing extreme thoracic deformity (see Fig. 7).

FIG. 5

A radiograph from Case 3 showing dorsal kyphosis with somewhat reduced inclination of the pelvic brim. The approximate plane of the brim is indicated in the figure (compare Fig. 6).

FIG. 6

A radiograph of the pelvis in Case 2. The inclination of the pelvic brim is increased, although this has not prevented engagement of the head. A plane of the brim is indicated in the figure. Photograph taken in the erect position at term.

FIG. 7
A radiograph of the chest showing extreme thoracic distortion in Case 4.

On admission her blood-pressure was 210/130 mm. Hg., and later the same evening it rose to 240/130 mm. Hg. The pain gradually improved over the next 24 hours. The blood-pressure fell a little, but remained at a very high level. Three days later labour began prematurely. The head entered the pelvis readily, and normal delivery followed an episiotomy after a very short labour. The child was alive and well, and weighed 4 pounds 8½ ounces. Two days after delivery the patient developed a further sudden and severe pain in her chest, passing from the dorsal region in the back to beneath the sternum. It was thought that this pain was probably of spinal origin and an X-ray was taken, which did not further the diagnosis. This pain also disappeared after some 12 hours, only to re-appear 2 days later.

This time the general condition of the patient was clearly worse. There was marked dyspnoea, cyanosis, and undue filling of the neck veins. The liver was palpable well below the costal margin. It was evident that the patient was going into heart failure. The pulse was very rapid, 140 per minute, and the patient was fighting for breath the whole time and complaining bitterly of her chest pain. She was treated along general lines for congestive cardiac failure, but this treatment was of no avail, and she died 2 days later.

The postmortem examination showed death to be due to congestive cardiac failure consequent upon gross distortion of the thorax, and hypertension. The heart showed moderate enlargement, due to dilatation of the right and left ventricles. There was a dissection aneurysm arising in the region of the aortic arch, and extending to the level of the bifurcation. There were several small tears in the intima of the aorta throughout its length, leading into this aneurysmal sac. The lungs showed congestion, and bronchi and trachea contained a quantity of mucopurulent fluid. The liver showed typical signs of passive congestion. There was also evidence of old chronic pyelonephritis.

Discussion

The Obstetric Problem

The exact nature of the pelvic changes which occur depends upon the situation of the spinal deformity. When the deformity occurs in the lumbar region the upper part of the sacrum is drawn backwards out of the pelvis, and the whole sacral wedge is tilted so that the lower end is thrust forwards. The inclination of the pelvic brim is reduced and in some cases the antero-posterior diameter of the pelvis is enlarged. As the natural wedge action of the sacrum of forcing apart the ilia is lost, the pelvis may be narrowed from side to side; this, combined with the forward thrust of the lower part of the sacrum, may, in some cases, give rise to considerable funnelling of the pelvis and contraction of the outlet. The decrease in pelvic inclination is well seen in Fig. 5 from Case 3; in this case, however, there was no lateral contraction of the pelvis, nor was the outlet reduced. In a series of 22 patients with this deformity Holmgren (1936) found 11 cases of outlet contraction, in all of whom the affected area of the spine was lumbar or lumbo-sacral.

If present in the dorsal region of the spine, the kyphosis will be compensated by a lordosis at a lower level. It is probable that little pelvic deformity will result, although, as the lumbar spine and sacrum are carried forward by the lordosis, pelvic inclination in this type of case will be increased and the pelvic brim may be almost vertical (Fig. 6).

The addition of scoliosis may, in some cases, produce obliquity of the pelvis in addition to the other effects described above.

In either case, where the spinal deformity is considerable, there will be much limitation of available room in the abdomen by the approximation of the ribs to the iliac crest. The enlarging uterus will, therefore, be thrust forwards in a pendulous manner. This can readily be seen in Fig. 1 although the patient was not pregnant at the time.

It is possible that this latter effect will interfere with the engagement of the head, and dystocia may arise from this cause. In the cases presented, however, this effect was not seen and, although each patient presented a pendulous abdomen at term, engagement of the head occurred without difficulty (Fig. 6).

The satisfactory outcome of vaginal delivery in all these cases suggests that, despite very marked spinal deformity and, in some cases, stunting of growth amounting almost to dwarfism, delivery may occur with surprising ease. It is true that the babies born to these patients were, for the most part, small, but patients of this sort seem to have babies smaller than the average. Mendelson (1948), reviewing 7 patients in 8 viable pregnancies, found only 1 child over 7 pounds in weight. In this series 6 children were delivered by the vaginal route and 2 by Caesarean section—1 for elderly primiparity complicated by toxaemia of pregnancy.

In the 22 patients which Holmgren followed through 29 pregnancies, there was an increased incidence of operative delivery—5 by forceps and 3 by Caesarean section. He concluded, however, that even in the presence of slight or moderate outlet contraction, deliveries may proceed normally, even with a fully developed child of average size.

With the present-day accuracy in radiological pelvimetry a careful study of the deformity can be made in each case, and the degree of pelvic contraction, if any, can accurately be ascertained. Although Caesarean section will be necessary in some cases it is suggested that, despite alterations in pelvic inclination, pendulous abdomen, or dwarfism, etc., the foetal head may become engaged at an early stage in labour, and delivery may occur without difficulty.

It is suggested, also, that there is more to be gained by this than the mere avoidance of a Caesarean section. It is likely that the operation carried out on a patient with considerable thoracic deformity will carry an additional risk of pulmonary infection, possibly precipitating cardiac failure. If Caesarean section is required, the advantages of local anaesthetic should be remembered.

One further point, however, is important in these hunch-backed patients. They go through life with a glaring deformity obvious to all. Many of them are acutely sensitive of their deformity and suffer from feelings of inferiority as a result. To deny such a patient the opportunity of showing herself capable of normal vaginal delivery will be to accentuate her feeling of inferiority. The pleasure which these patients felt at being told even that a vaginal delivery was possible was most gratifying, surpassed only by the satisfaction they experienced on accomplishing it.

The Dangers of Cardiac Failure

It is clear from perusal of the literature that there is a very real danger of cardiac or respiratory complication in patients with marked kyphoscoliosis. This is particularly so when the deformity affects chiefly the thoracic region. In any patient with dyspnoea as a result of this, the additional strain imposed by pregnancy may have serious or even fatal results.

Chapman *et al.* (1939) found the average duration of life in patients with kyphoscoliosis was 30 years. Death is in most cases due to cardiac or respiratory causes. The effects of serious thoracic deformity, such as that in Case 4 (Figs. 4 and 7), are evident on both sides of the heart. The load on the right side of the heart is increased as a result of pulmonary compression with the formation of areas of atelectasis and emphysema. There is often rigidity of the thoracic cage with limitation of pulmonary expansion, whilst, at the same time, diaphragmatic flattening results in poor abdominal respiration. The respiratory exchange is inefficient, and the vital capacity is reduced. The likelihood of pulmonary infection is increased, and pulmonary adhesions as a result of this may be found. Enlargement of the right ventricle with hypertrophy of the walls is often found in these cases (Case 4). The strain on the left ventricle will occur also from rotation of the heart in the chest possibly at the same time from kinking of the great vessels which may also be present. It is possible this effect may have preceded the aneurysm formation in Case 4.

All these changes will be aggravated by the additional burden imposed by pregnancy.

Jensen (1938) collected from the literature 50 fatal cases of kyphoscoliosis complicating pregnancy. The details are not complete in all, but it is clear that the majority of deaths were due to cardio-respiratory failure, and that true obstetrical complications accounted for a relatively small number. He found that there was a greater risk in those patients in whom the deformity was thoracic and who had previously had dyspnoea. He concluded, also, that the risk was greater with increasing maternal age, and that the most dangerous period was the first 24 hours post-partum. Of Holmgren's 22 patients 4 developed cardiac failure, although 3 of these recovered. Of the 7 patients reported by Hamilton and Thomson (1941) in Boston, 2 developed serious cardiac symptoms, and 1 more minor symptoms, although all recovered. In a similar number of patients reported by Mendelson (1948) 4 were unaffected, 1 developed minor symptoms, and 2 were seriously ill with cardiac failure; these patients also recovered. In the present series of 4 patients, 1 death from heart failure took place. It is clear that there is a con-

siderable risk of cardio-respiratory complications in this type of case.

Special cardiac evaluation may, therefore, be indicated in the patient with kyphoscoliosis who is contemplating marriage or pregnancy. The presence of dyspnoea, cyanosis, or severe thoracic deformity such as in Case 4 (Fig. 7), and the finding of a low vital capacity may be sufficient evidence to advise against the additional burden of pregnancy. If the patient is already pregnant, the possibility of serious cardiac embarrassment should be borne in mind, and the activity of the patient limited accordingly. Treatment for the established heart failure will follow general lines, although there is some evidence that morphia, which is valuable in most cases of heart failure, may be dangerous in this type of case (Daley 1945).

Conclusions

Due to the pelvic deformities which may be associated with kyphoscoliosis the incidence of dystocia in this type of case will be somewhat higher than in a normal case. Nevertheless, even in the most unlikely cases where there may be pelvic deformity, dwarfism, pendulous abdomen, or even moderate outlet contraction, vaginal delivery may occur with surprising ease. We will be doing this type of patient a great service by allowing her to have a baby naturally, and may improve her morale, making her less conscious of the inferiority which she must feel as a result of her deformity. Should Caesarean section be necessary it is probable that it will carry an increased risk of pulmonary infection, especially if distortion of the thoracic cage is considerable.

The real problem presented by this type of case may well be the possibility of pulmonary or cardiac complications. This will be particularly so where the deformity is thoracic, and where the patient has previously suffered from dyspnoea. Special cardiac evaluation is indicated in these patients before and during pregnancy.

Summary

Four cases of kyphoscoliosis complicating pregnancy have been briefly described; during the 6 years these patients were delivered vaginally of 9 children. The babies were of smaller than average size, and were all alive and well. Two were delivered by forceps extraction, and 7 were born normally. One mother died from heart failure. The varieties of pelvic deformity which may be associated with kyphoscoliosis have been described, and the obstetric problem discussed with reference to the literature. The importance has been stressed of the danger of cardiac or respiratory complications when the kyphoscoliosis affects the dorsal region of the spine.

I would like to thank Dr. E. A. Gerrard and Dr. R. Newton for permission to publish these cases. My thanks are due also to the staffs of the photographic departments in the Manchester Royal Infirmary and the Sheffield Royal Hospital for illustrations.

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THE PREVENTION OF ECLAMPSIA

An Australasian Experiment

BY

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THE bases of this paper are the beliefs that:

(1) Eclampsia is the terminal catastrophe of a disease which, for want of a better term, is called " Toxaemia of Pregnancy ".

(2) It is a catastrophe which gives due and detectable warning to all who seek.

(3) The irreducible minimum of its incidence, which is zero, is attainable.

These convictions are the result of an experiment carried out since 1947 concurrently but independently in Sydney and Dunedin; an experiment consisting solely of the exercise of stringent, meticulous and discriminating supervision of pregnant women with a full recognition that seemingly insignificant deviations from the normal may and frequently do herald the genesis of a mortal disease which can destroy a woman and her child. This supervision includes both the greatest possible vigilance in antenatal care and immediate hospital treatment of the earliest signs of toxaemia of pregnancy. Axiomatically, we have yet to see a case of eclampsia which did not give warning signs often disregarded because of their apparent insignificance.

We define toxaemia of pregnancy as a disease arising during and because of pregnancy in a woman who was, prior to conception, a healthy person. The usual grouping of several unallied diseases under the generic term of " toxaemia of pregnancy " is unsatisfactory and inconsistent. Pre-existing hypertension or chronic nephritis is not a toxaemia of pregnancy; these diseases arise apart from pregnancy, being possible sequels of scarlet fever, acute nephritis, or what you will. They are associated diseases and should be so classified just as diabetes, cardiac disease or tuberculosis. It is inconsistent to label chronic nephritis a toxaemia of pregnancy and to call diabetes a disease associated with pregnancy. All such diseases and the pregnancy can be mutually influenced for good or ill but they should not be called toxaemias of pregnancy since they may exist for years before and after the occurrence of gestation.

If this simplification be accepted there is not need for the further confusion of such terms as " pre-eclamptic toxaemia " the simple term " toxaemia of pregnancy " being applied to a specific disease dependent upon pregnancy and occurring in no other condition, a disease, moreover, which conforms to a precise pattern with few and occasional aberrant symptoms.

The well-known initial phenomena are those due to retention of water and the sodium ion manifested by undue increase of weight and ultimately by obvious subcutaneous oedema accompanied by increase in systolic and diastolic blood-pressures. In the main the disease is one of gradual progress but, if it is not adequately treated and the pregnancy continues long enough, the later dangerous signs and symptoms of damage to parenchyma will inevitably appear. Whether these are due to the intracapsular pressure of tissue oedema or to the arterial spasm suggested by Trueta is of small practical moment. Among these prodromata of the final catastrophe of eclampsia we include albuminuria, which is evidence of damage to the parenchyma of the kidneys, regarding proteinuria as a late and dangerous sign and believing that toxaemia of pregnancy can be recognized and treated prior to its appearance. It is true that occasionally the progress of the disease may be more rapid and dramatic, but seldom if ever beyond detection in time to prevent eclampsia.

It would be temerity to claim that antenatal care in Australasia differs markedly from that of other clinics but we do claim that the more stringent the observation of patients the less eclampsia there will be and that, if it is scrupu-

lous enough, this disaster can be prevented. We believe that if eclampsia should end a pregnancy which we have supervised then we should write the mishap down as a failure due to something we have or have not done; this being the only wholesome mental attitude towards these tragic cases. Such dogmatic statements need, of course, justification by results.

During the past 19 years 10,364 women have been cared for by the Department of Obstetrics of the University of Otago as "booked" cases, the observations made and the criteria of normalcy established by the same people. The incidence of cases varied with the fluctuating birth-rate, so the period is divided into three during which the number of cases is similar.

Sydney, where a campaign against eclampsia has been waged concurrently with that in Dunedin, that is, since 1947. In the series assessed of 6,600 "booked cases" treated between March 1950 and October 1951 there has been no case of eclampsia (Hughes, 1951). So this Australian experiment, after approximately 3 years work, had reduced the incidence of eclampsia to 1 case in 9,612 "booked" maternity cases. It has been suggested that such a result can be easily accomplished if for expectant treatment is substituted frequent and early inductions of labour prior to viability or with a high level of prematurity. This criticism can be promptly answered by the facts that in the third series in Table I the average duration of the pregnancies terminated by

TABLE I

Period	Booked cases	Toxaemic	Eclamptic	Maternal deaths	Medical induction	Surgical induction	Caesarean section
Jan. 1932 to July 1940	3,714	208 or 5.6%	6	3	74	44	10
July 1940 to Jan. 1947	3,638	187 or 5.1%	4	0	88	33	9
Jan. 1947 to Sept. 1950	3,012	164 or 5.4%	1	0	75	35	8

None of the maternal deaths in the first series was due to eclampsia, 1 resulted from cerebral haemorrhage at the 31st week and 2 from antepartum haemorrhage followed by anuria at the 34th and 39th week respectively.

In 1947 the campaign against eclampsia was intensified by more frequent antenatal examinations, a fuller recognition of the insignificance of minor deviations from the normal and by the institution of hospital treatment in the initial stages of the disease prior to the appearance of danger signs, including proteinuria. Table I shows clearly that the incidence of toxaemia is constant through the three series of cases and the progressive decline in eclampsia until in the last series of 3,012 cases there was only 1 of eclampsia. This virtual extinction of eclampsia in 3,012 consecutive unselected cases is regarded as satisfactory but it has been surpassed by the work of the Women's Hospital, Crown Street,

induction was 38 weeks whilst the average duration of the pregnancies ending in spontaneous labour after expectant treatment was 37 weeks, the average duration of expectant treatment being 12 days, the longest 29 and the shortest 3.

In the New Zealand series of 10,346 deliveries a careful assessment has been made of the wastage among 579 infants born of toxaemic mothers (Table II).

In addition 6 pregnancies ended prior to viability, 2 by spontaneous labour following accidental antepartum haemorrhage, 1 by surgical induction and 3 of severe toxaemia with rapid deterioration by Caesarean section; none of these occurred in the third series.

All cases of recent intra-uterine death, maceration, and accidental antepartum haemorrhage are accepted as liabilities, being regarded as due to human frailty which failed to judge advantage-

TABLE II

Infant Mortality of Children of Toxaemic Mothers

STILLBIRTHS (S.B.)

Period	Infants including twins	S.B.	Average duration of pregnancy Weeks	Spont. labour	Medical induction	Surgical induction	Caesarean section
Jan. 1932 to July 1940	213	12	35.5	5	2	2	3
1 death due to obstructed labour, 5 due to accidental antepartum haemorrhage.							
July 1940 to Jan. 1947	196	20	35	15	4	0	1
Recent intra-uterine death 3; macerated 4; anencephaly 1; erythroblastosis 2; accidental antepartum haemorrhage 5.							
Jan. 1947 to Sept. 1950	170	6	36	4	2	0	0
Obstructed breech delivery 1; macerated 1; accidental antepartum haemorrhage 2.							

NEONATAL DEATHS

Period	No.	Duration of pregnancy Weeks	Spont. labour	Medical induction	Surgical induction	Caesarean section
Series 1 as above	4	37	1	1	1	1
Series 2 as above	6	35	3	2	0	1
Series 3 as above	2	34	0	0	0	2

ously the time for induction. Anencephaly, erythroblastosis, and obstructed labour are regarded as accidents unconnected with toxaemia. The total infant wastage among the 579 infants born of toxaemic mothers was 8.8 per cent, in the first series 9 per cent, in the second 12.7 per cent and in the third 4.1 per cent.

The over-all infant wastage among 10,500 births, including twins but excluding toxaemic cases, was 3.7 per cent. Of the 51 infant deaths attributable to toxaemia 28 were associated with spontaneous labour. The average duration of the unfruitful pregnancies ending with spontaneous labour or by induction was 35.4 weeks whilst the average duration of toxaemic pregnancies producing living infants was 38 weeks.

The improvement in infant loss during the intensified campaign of the third period is very marked, being 4.1 per cent, which compares favourably with the wastage in non-toxaemic pregnancies of 3.7 per cent. Fourteen of the infant deaths were due to accidental haemorrhage and 9 occurred *in utero* prior to labour, a total of 23, which is 45 per cent of the wastage associated with toxameia. This at least suggests that lives could be saved by more timely induction of labour to forestall such accidents.

The Pattern of the Campaign

This has the elementary objective of catching and treating the disease in the early stages before evidence appears of damage to such vital organs as the kidneys, liver, and brain. Since it is believed that toxaemia of pregnancy is ushered in by water and sodium retention we consider that careful study and assessment of weight gain can give gravely suspicious if not certain information of the presence of tissue oedema. In 1948 the Obstetrical Research Committee of the Medical Research Council of New Zealand investigated the gain of weight during pregnancies of the white women of the Dominion (Dawson and Borg, 1949).

One thousand case records were studied and 863 accepted as giving worthwhile data, 93 being cases of toxaemia. The average weight gain throughout pregnancy of the 770 women regarded as clinically normal was 24.85 pounds and between the 24th and 40th the average gain was 16 pounds or one pound per week; 30 per cent either lost weight or gained not at all during the last 2 weeks of pregnancy. The average blood-pressure of 73 per cent of these women was remarkably constant throughout the pregnancies, being 119 systolic and 72 diastolic, millimetres of mercury. It was a little disconcerting to find that the remaining 27 per cent, although apparently clinically normal, gained more than 30 pounds with an average blood-pressure of 124/75. The majority of these deviations were due to faulty régime of life capable of correction by improved habits and diets. It is, of course, possible that there may have been early tissue oedema and that, had treatment been neglected or the pregnancies lasted longer, other toxaemic symptoms might have appeared. A study of the weight gain of the 93 women with clinical signs of toxaemia showed that the average total gain during pregnancy was 19 per cent greater than the normal and the gain during the 4 weeks preceding term or induction of labour was 54 per cent greater with a concurrent average blood-pressure of 147/94. This investigation indicates that in nearly 75 per cent of cases study of weight gain gives valuable evidence of the initial water retention.

The recording of weights is made with care to avoid accidental errors, the women being weighed in their usual and unaltered clothing, with bladders empty, approximately the same time after an average meal and on the same machine which, from time to time, is tested.

Blood-pressure

Rise of blood-pressure, which occurs concurrently with or soon after early evidence of water retention, is regarded as the more valuable sign and individually of greater value than weight gain, but we believe that studied together each endorses the other. The average blood-pressure of healthy young pregnant women is approximately 120/70, but since an average is the resultant of figures both higher and lower there must be a range of normalcy which allows of reasonable variations. Therefore, in the absence of other signs and symptoms, we accept 100/60 to 130/75 as within the limits of normal, but approach to the latter figure demands enhanced care and supervision. We have learnt from experience that most young women who at, say, the 34th week of pregnancy have a persistent blood-pressure of 130/75 to 85 will, in the course of a few days or weeks develop the later signs of toxaemia. In the above study of weight gain 93 women were obviously toxaemic during the last 4 weeks of pregnancy and of these 63 at the 34th week had an average blood-pressure of 135/85.

We agree wholly with T. Dixon Hughes of Sydney that increase of blood-pressure must be studied in relation to the basal blood-pressure of each patient with less reliance on any arbitrary standards. For example, we regard a rise from a basal pressure of 110 to 130 as of greater moment than a rise from 125 to 135. Every effort is made to establish a basal level early in pregnancy and when this is impossible, and the blood-pressure seems inappropriate to the state of the patient or the duration of the pregnancy, it is our practice to ask the cardiovascular clinic to determine a basal rate after proper rest and sedatives. Having this as a guide it is then possible to assess any subsequent rise.

All this has greatly increased the work of the antenatal clinics but with the admirable co-operation of the nursing and medical staffs an almost personal contact with the patients is

maintained. So much so that it is difficult to find for teaching purposes patients showing any of the later "pre-eclamptic" phenomena of toxaemia.

Treatment including biochemical investigations follows orthodox modern methods but we know that toxaemic cases cannot be treated as outpatients or in their own homes since the essential physical and mental rest cannot thus be obtained. In the initial stages of the disease the results are good and many women are allowed to return home to continue their pregnancies, but with an almost daily watch for the relapse which will occur unless forestalled by the onset of labour; although temporarily relieved these women are not cured and are still toxaemic. If proteinuria or other danger signs appear induction of labour is usually thought necessary unless there is a very prompt and marked response to treatment. This procedure puts a very heavy strain on the antenatal beds but happily, so far, enough have been available.

The essential points in a campaign against eclampsia are well summed up by T. Dixon Hughes in these words:

(*a*) Antenatal care must be adequate and must comply with a high standard of efficiency demanding an exacting control of patients almost personal in nature.

(*b*) The blood-pressure must be properly assessed in relation to the basal pressure.

(*c*) The weight must be carefully observed and its significance as an indication for treatment, control and closer observation must be appreciated.

(*d*) Previous arbitrary ideas of how often a patient should be examined must be abandoned.

(*e*) It must be recognized that the presence of albumen in a catheter specimen of urine is a late sign of toxaemia and that control must commence before its appearance.

It is just this recognition of the important significance of seemingly trifling deviations from the normal that explains the success of the Australasian experiment. Picturesquely perhaps, we regard pregnancy as the bridge which carries women from maidenhood to motherhood and that, if the bridge is unstable, it must be immediately shored up by treatment or the journey ended before the danger zone is reached.

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SARCOMA BOTRYOIDES OF THE CERVIX

With Two Case Reports

BY

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SARCOMA botryoides is a rare tumour arising from the cervix or vagina with a typical clinical picture of recurring polypoidal masses filling the vagina. Histologically it presents the picture of a mixed mesodermal tumour of embryonic type. A similar histological type of tumour occurs in the body of the uterus but it does not present the botryoid appearance, probably because there is so little room for expansion within the uterine cavity.

The histological diagnosis is often extremely difficult. The degree of differentation varies so much that it may be impossible to demonstrate the typical embryonic tissue, with the result that some tumours have been thought to be innocent and some to be spindle-celled sarcomata. The true nature of the tumour has often not been revealed until the recurrences have been examined. Recurrences are usually local but distant metastases do occur. The prognosis is said to be almost invariably fatal, the average duration of life being 1 year. The literature records only a very few cases of survival which are as follows.

Sarcoma Botryoides of the Cervix

(1) A 14-year survival recorded by Randall (1943). The patient was a girl of 8 years who presented with a typical tumour both clinically and histologically. Following local removal she was treated by 2 small applications of radium.

(2) A 6-year survival reported by Puech and Massabuau (1908). This was a typical case both clinically and histologically.

Rickford (1945) recorded the 2-year survival of a case typical of sarcoma botryoides clinically but no embryonic tissue could be identified. The tumour was reported as a spindle-celled sarcoma with numerous giant cells and some hyperchromatic nuclei. The patient was a woman of 54, who presented with a typical recurring polypoidal tumour. She was treated by 50 mg. of intra-uterine radium for 48 hours, the dose being repeated after an interval of 3 weeks.

Sarcoma Botryoides of the Vagina

(1) A 5-year survival. This case was reported post-operatively by Ulfelder and Quan (1947). The patient was a child of 20 months who presented with a typical tumour of the vagina. In this case Dr. J. V. Meigs performed a hysterectomy and excision of the vagina, leaving only that portion under the urethra. The tubes and ovaries were spared. Dr. Meigs in a personal communication tells us that the child is now well and free from recurrence 5 years later.

(2) A 1½-year survival reported by Meikle (1936). The patient was an unmarried woman of 48, who presented with a typical tumour, which had infiltrated the vaginal wall and the right broad ligament and there was a metastatic

deposit in the uterine wall. In this case Mr. Victor Bonney performed a radical abdominal hysterectomy and vaginectomy.

Tracy (1930) reported a 6-year survival of a case typical of sarcoma botryoides clinically but the diagnosis could not be completely substantiated as no embryonic tissue could be found, the case being reported as a spindle-celled sarcoma with no heterologous tissue. The patient was aged 35 years and presented with a recurring polypoidal vaginal tumour. She was treated by simple enucleation twice and this was followed by 100 mg. radium for 24 hours. She later developed a recto-vaginal fistula which healed spontaneously.

In view of the extremely low survival rate of these cases we are now reporting 2 further cases which have survived 10 and 7 years respectively after treatment.

CASE 1

M. H., aged 14 years, presented in 1942 with a mass appearing at the vulva and a history of an offensive vaginal discharge for 2 months. She had had 4 menstrual periods 10, 8, 4, and 3 months previously. Examination under anaesthesia revealed a pale yellow translucent grape-like mass which filled the vagina and protruded at the vulva. It was attached by a pedicle to the right lip of the cervix just inside the cervical canal and was adherent to the vaginal vault. There was no evidence of any extension of the lesion. The pathologist reported the tumour to be a spindle-celled sarcoma with numerous mitoses in the more cellular parts. Scattered round cells with bulky cytoplasm were found which closely resembled embryonic muscle cells although striation was absent.

The parents were unwilling for radical surgery especially when such a gloomy prognosis had to be given, but the matter was settled by a recurrence of the tumour to a similar size within 10 weeks. The tumour presented the same clinical picture and was again attached to the cervix and the posterior vaginal fornix. The main bulk of the tumour was removed vaginally and a total hysterectomy and bilateral salpingo-oöphorectomy, with wide excision of the parametrial tissue and the upper half of the vagina, was performed. This was followed by a course of X-ray therapy, 2,000 r. being given to the pelvis. This time the section showed a large firm central core with typical embryonic mesenchyme as well as immature glandular tissue. Large areas of necrosis were present.

The child made an uneventful recovery. She married 8 years after the operation. Now 10 years later she is 5 feet 3 inches tall, weighs 8½ stone, is a healthy young woman of 24, and her marriage is a success.

CASE 2

G. G., a married woman of 44, presented in 1945 with a history of vaginal bleeding and an offensive discharge of 6 months duration with the recent appearance at the vulva of a tumour. She had had a child and menstruated regularly up to the time that the bleeding had started. On examination under anaesthesia a large polypoidal mass was found to be filling the vagina and presenting at the vulva. It was attached to the cervix by a pedicle which was divided. The section showed no evidence of malignancy. The patient's husband was seriously ill and later died and so the question of further surgery had to be postponed. However, within 3 months the tumour had recurred to a similar size and was again attached to the cervix. This time the section showed a typical embryonal sarcoma. A total hysterectomy and bilateral salpingo-oöphorectomy, with a wide excision of the parametrium and removal of the upper half of the vagina, was performed. The specimen showed an extension of the embryonal sarcoma to the endometrium of the fundus of the uterus. The patient made an uninterrupted recovery and is now fit and well 7 years later.

SUMMARY

Two cases of sarcoma botryoides of the cervix are reported, both of which recurred within 3 months of local removal and both of which are alive and free from recurrence, the one 10 years and the other 7 years after radical abdominal excision.

We are indebted to Mr. H. L. Shepherd and to Dr. Mabel Potter for their kind help and permission to publish these cases.

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SARCOMA BOTRYOIDES OF THE VAGINA AND CERVIX IN CHILDREN

A Report of 2 Cases and a Plea for Early Clinical Diagnosis

BY

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THERE are in the museum of the Department of Obstetrics and Gynaecology in the University of Edinburgh 2 specimens of botryoid sarcoma of the genital tract in children. These have both been added to the museum in the last 10 years and, as far as we have been able to ascertain, only 1 other case of this condition has been seen in Edinburgh within living memory. Moreover, both these recent cases were children who lived elsewhere and were brought to Edinburgh for treatment. The rarity of the condition is further emphasized by the fact that a case recently reported by Murphy and Du Shane (1948) was the first ever seen at the Mayo Clinic and the case reported by Ulfelder and Quan (1947) was the only example of the condition seen at the Massachusetts General Hospital, Boston.

The term sarcoma botryoides, or grape-like sarcoma, describes the condition so graphically that it persists in the literature despite many criticisms. There is general agreement, however, that the condition is a mixed mesodermal tumour. In young children the tumour may arise from the vagina or from the cervix and in the later stages it is sometimes difficult to state with certainty the primary site of origin.

We do not propose to review the literature on the subject, as Shackman (1950) has so recently done so. We agree with him that the articles by Shaw (1928), Adler (1928), and McFarland (1935) are the most comprehensive and helpful. In addition the thesis by Meikle (1936), although considering uterine rather than vaginal mixed mesodermal tumours, gives much valuable information. The purpose of this paper is to place on record the histories and to publish photographs of the 2 Edinburgh cases.

CASE 1

June 1943: J. B., an otherwise healthy child aged 6 months, was admitted to a hospital in England because her mother had noticed 2 red polypi protruding from the vulva. There had been no bleeding and no discharge. On admission the polypi were found to be arising from the upper vagina or cervix and a portion was excised for histological examination. The report from an experienced pathologist did not suggest malignancy and indicated that the polypus consisted of "pleomorphic" tissue covered by squamous epithelium.

August 1943: The tumour was found to have grown rapidly. There was bleeding and infected discharge. Two large masses protruding from the vulva were removed by diathermy. X-ray of the chest was negative. Histological examination now showed the presence of striated muscle cells and the diagnosis of sarcoma botryoides was reached.

September 1943: The child was re-admitted to hospital. She was gaining weight and her general condition was excellent, but polypi were again protruding at the vulva and arrangements were made for the patient's transfer to Edinburgh for treatment. The child was admitted to the Royal Infirmary under the care of one of us (E.C.F.). Her general condition was excellent and general medical examination showed no abnormality. Protruding from the vulva were reddish, polypoid, soft masses looking like a bunch of irregular-sized grapes (Figs. 1 and 2). The vagina was found to be distended and completely filled by tumour. Per rectum, the soft mass of the distended vagina was found to fill much of the pelvic cavity and to reach the pelvic brim. The uterus could not be felt. As much as possible of the tumour was removed by diathermy. High-power section of the tissue removed confirmed the presence of striated muscle cells (Fig. 3). Other cells were irregular in size and shape, with uneven staining of nuclei and many mitoses.

11th October, 1943: After consultation with the radiotherapist, radium treatment was instituted and consisted of the daily insertion into the vagina of a specially prepared applicator containing 15 mg. of radium. The applicator was left in position for 7½

hours on each of 10 consecutive days. The total dose was 8,000 r.

19th November, 1943: The child's condition was excellent. There was no abnormality in bladder or bowel function. Examination under anaesthesia showed no growth in the vagina, the walls of which felt granular. The small uterus could be felt above the vaginal vault. X-ray of the chest was negative.

9th January, 1944: Information was received that the tumour had recurred and was growing rapidly, the child's condition was failing. No further irridiation was advised.

11th April, 1944: The child died. No information is available about terminal symptoms.

Autopsy. There were no metastases in bones, lungs or lymph nodes. The vulva, pelvic organs and kidneys were sent to Edinburgh and are depicted in Fig. 4. The autopsy revealed no other abnormality.

The kidneys are free of tumour and show mild hydronephrosis. The tumour involves the whole of the vaginal wall and has invaded the bladder. It has become much more solid and the lumen of the vagina is very narrow. It is not possible to be certain whether the primary site was the vagina or the cervix. The body of the uterus is tiny and is not involved. Histological examination shows a variety of cells ranging from spherical and polyhedral to elongated muscle cells and fibroblasts. There is still a covering of squamous epithelium (Fig. 5).

CASE 2

January 1949: M. M., a child aged 18 months, was noticed by her mother to have vaginal bleeding. A month later a small swelling was seen to protrude at the vulva.

31st March, 1949: The child was referred to the out-patient department of a hospital where the consultant found a polypoid tumour growing from the left postero-lateral wall of the vagina. The polypus was avulsed and sent for histological examination. The pathologist to the hospital reported "squamous tag with subacute inflammatory change. No evidence of malignancy in the sections examined".

7th July, 1949: The patient was seen again on account of further vaginal bleeding. Under anaesthesia a polypoid growth was found to be filling the vagina. The protruding portion was excised for histological examination. Report: "Vascular squamous papilloma with marked oedema and infection of the stroma. No evidence of malignancy in section examined".

21st and 28th July, 1949: In the light of the histological report local excision of the polypoid mass was carried out and at a second operation the vaginal wall was thoroughly curetted.

6th October, 1949: Symptoms had recurred and under anaesthesia the whole vagina was again found to be distended by polypoid tumour tissue. The histological report was: "the stroma now shows sarcomatous change. Other features of the tissues are as before". This slide was subsequently examined by another pathologist who was not satisfied that there was any evidence of malignancy.

25th October, 1949: In view of the report of malignant change the child was transferred to the Royal Infirmary of Edinburgh under the care of Professor Robert Kellar. The child was now over 2 years of age and was well developed and well nourished. She looked pale, but the haemoglobin was 80 per cent and no abnormality was found on general examination. On inspection of the vulva a cluster of translucent polypi was seen protruding from the introitus (Figs. 6 and 7). Under anaesthesia the vagina was found to be grossly distended by vesicles and purulent discharge. The polypi were growing from the whole vaginal canal. The fundus, cervix and uterine appendages were not felt.

2nd November, 1949: The vaginal wall was scraped with the curette and numerous vesicles removed (Fig. 7). An applicator containing 15 mg. of radium was inserted into the vagina and left in position for 32¼ hours.

15th November, 1949: Second application of radium as before, but with the main concentration of radium at the vulvar end of the tube. Even in the short interval the vagina was again found to be filled with tumour tissue and was so distended that the length was almost 3 inches.

26th January, 1950: Symptoms and signs having recurred the patient was re-admitted for assessment but it was decided that further irradiation would not be advisable. The child was transferred to the Royal Hospital for Sick Children under the care of Professor R. W. B. Ellis. Her general condition deteriorated and she developed signs of bladder obstruction and ascending urinary infection. Chest X-ray remained negative.

7th April, 1950: Child died.

Autopsy. No abnormality in the head, thorax, gastro-intestinal tract, spleen, liver, pancreas, suprarenal glands, or peritoneum. The kidneys showed chronic pyelonephritis; the ureters were distended and the bladder greatly distended due to obstruction at the bladder neck and urethra by pressure of tumour and vagina but with no direct involvement by tumour tissue (Fig. 10).

The vagina was enormously distended by grape-like collections of tumour tissue which had spread to the parametrium on the left side. The uterus, ovaries and tubes were normal.

Microscopical findings. "One of the grape-like tumour nodules was sectioned and was found to be covered by squamous epithelium. The centre of the nodule was very myxomatous. Immediately beneath the epithelium there were collections of tumour cells showing few mitoses. These cells were spindle-shaped and had hyperchromatic nuclei. A few had a rather eosinophilic cytoplasm, suggesting they originated from muscle tissue. The appearance was that of sarcoma botryoides. The tumour was not very vascular and the stroma was scanty. A further section from a

FIG. 1

Case 1. J. B., aged 9 months, showing the polypoid protrusion at the vulva.

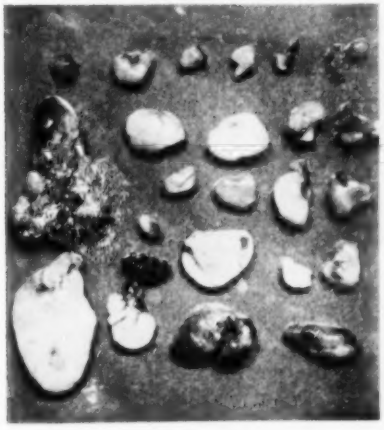

FIG. 2

Case 1. Some of the polypi removed from the vagina by curettage. The varying size and shape of the grape-like swellings are seen (natural size).

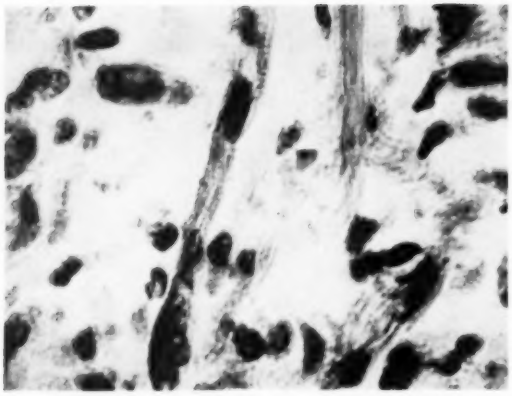

FIG. 3

Case 1. Striated muscle cells. ×400

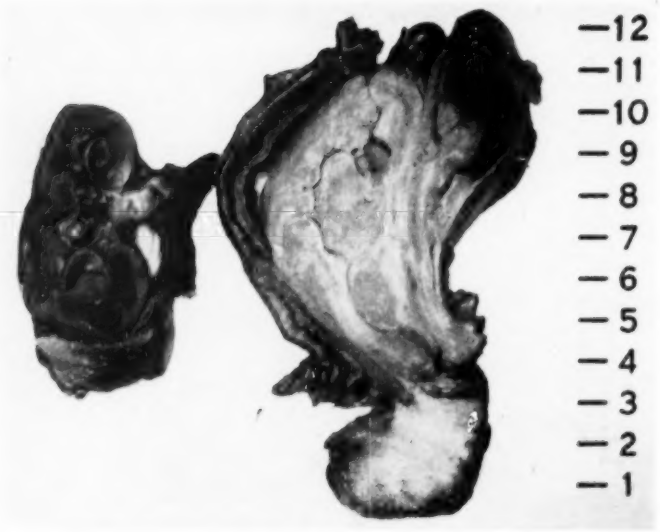

FIG. 4

Case 1. Autopsy specimen. The kidney shows mild hydronephrosis. The vagina is completely filled by tumour, but the narrow lumen can still be seen. The tumour has involved the bladder wall and projected into the cavity. The small normal uterus is seen at the vaginal vault behind the bladder. The pelvic colon and rectum are not involved.

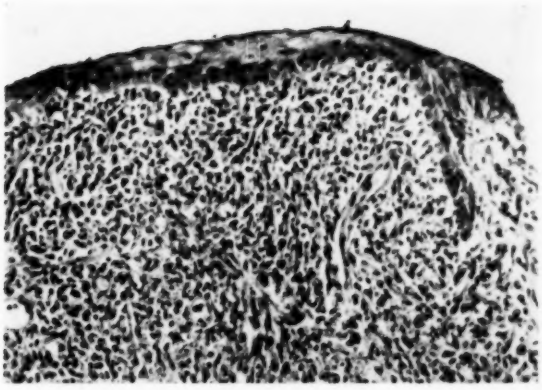

FIG. 5

Case 1. Microscopic appearance of the tumour. The squamous epithelial covering is seen, but below this the tissue is now cellular and the cells are grossly irregular in size and shape. × 120

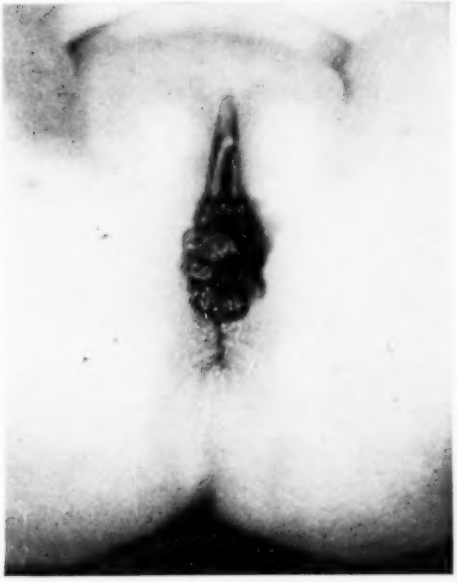

FIG. 6

Case 2. M. M., aged 2 years. Multiple polypoid swellings are seen protruding from the vulva.

FIG. 7

Case 2. Some of the vesicular polypi after removal.

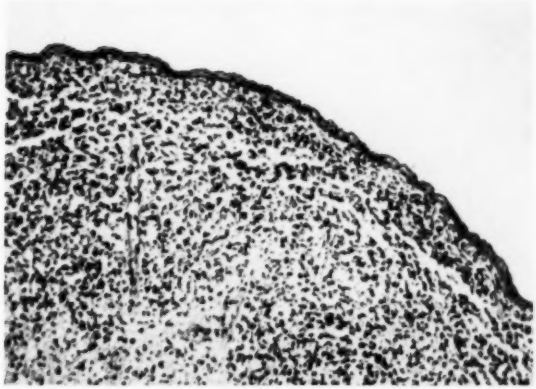

FIG. 8

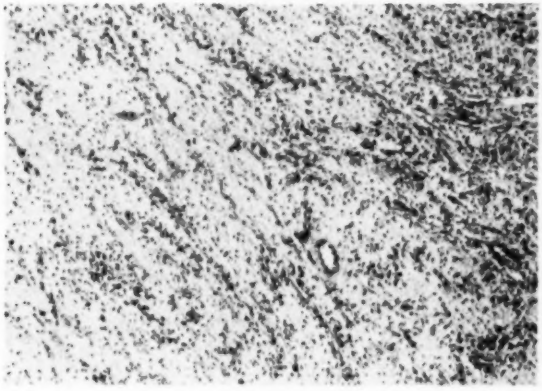

FIG. 9

Case 2. Microscopic appearance of the tumour at the time of radium treatment.

Fig. 8 shows the squamous epithelial covering. The tissue underlying it is cellular, but Fig. 9 from the same block shows the typical myxomatous appearance. In the earlier sections, which are not now available to us, the whole tumour consisted of myxomatous stroma with simple epithelial covering. ×65

FIG. 10

Case 2. Autopsy specimen. The vagina is grossly distended and elongated. The vesicles are arising from most of the vaginal surface. The urethra is constricted, although not invaded. The tumour has spread round the urethra and vesicles are seen anterior to it. The bladder is grossly distended. The small uterus is not involved.

tumour nodule has a much more cellular and less myxomatous appearance than the previous section. The covering squamous epithelium has been largely stripped off and the underlying tumour tissue is densely cellular. Long acidophil strap-like cells are present and many of these show cross-striations indicating their muscular nature. Their nuclei are long, elliptical and darkly staining. The remaining cells have round, darkly-staining nuclei and scanty cytoplasm. The centre of the tumour is myxomatous."

The only other points of interest from the microscopical findings were the confirmation of chronic pyelonephritis and the presence of very early involvement by tumour of the para-aortic lymph nodes.

Diagnosis

These two case reports show that in both there was considerable delay in reaching the correct diagnosis. We feel that some discussion of the causes of delay may be of service in aiding earlier diagnosis in the future.

The extreme rarity of the condition. Most gynaecologists never see a case of sarcoma botryoides during their professional lifetime. The tumour, as it affects children, has not been discussed at any length in this journal since 1936, and we have been unable to find any previous publication in this journal of clinical or macroscopic photographs of the condition. We hope that the publication of the present photographs may be of interest to those who have not encountered a case.

The initially innocent clinical appearance of the tumour. The first protrusion at the vulva is often of a simple-looking polypus very similar to the benign mucous polypus of the cervix, so familiar to all as an essentially benign lesion.

Benign histological features. The myxomatous tissue of the polyp is covered by a layer of normal squamous epithelium and this characteristic of the lesion may mask the malignant nature of the tissue.

Bearing these points in mind, we have sought information about the incidence of innocent polypoidal lesions of the genital tract in children. It would appear that simple polypi in children are even rarer than sarcoma botryoides. James (1951), in reporting a benign polypoid tumour of the cervix in a girl 3 years old, states that a search through the indexed literature of the past 20 years failed to show any report of a similar case. We have been equally unsuccessful in finding reports of simple lesions which might be confused with sarcoma botryoides. In the standard text-books, very little is said about the occurrence of simple polypi in children. Beckwith Whitehouse (1935) illustrates polypi from the cervix of a child aged 19 months " reported by a competent pathologist as consisting of unstriped muscle and connective tissue ". By inference he indicates the rarity of a lesion of this type. Wharton (1947) states of cervical polypi that " they occur chiefly in adult women, being rather rare in girls ". None of the other works which we have consulted make any reference to benign polypi in childhood. Personal inquiry amongst our colleagues confirms our opinion that such cases are rarely encountered. Israel (1940) and Geiger (1936) in their reviews of cervical polypi had no cases under the age of 20. Schauffler (1941), in his book *Paediatric Gynaecology*, does not mention benign polypoid lesions of the genital tract.

Because we felt that such cases might come under the care of the paediatrician rather than the gynaecologist we have consulted the principal manuals of paediatrics without finding any reference to such a lesion. Taussig (1948) refers to Bennecke's complete table of tumours in childhood and makes no mention of simple polypi. He goes on to say: " while tumours of the genital tract in girls are relatively infrequent, they assume importance because of the high proportion of them that are malignant ".

This then is the point we wish to emphasize: sarcoma botryoides may be rare, but any simple lesion in children remotely resembling it is even rarer. If, therefore, an infant or young child presents with a polypus or polypi protruding from the vulva or lying in the vagina, the provisional diagnosis of sarcoma botryoides should at once be made. Even if the histologist's report does not at once confirm the diagnosis, the clinician should be very reluctant to change his opinion as the histologist may well be misled by the benign squamous epithelial covering and myxomatous stroma. Amolsch (1939) in reporting 6 cases of mixed mesodermal tumours of the uterus and vagina (5 in adults and 1 in

a child) drew attention to the fact that in all 6 cases the tumour presented as a mucosal polyp and in each case the initial pathological diagnosis was benign polypus. Maslen Jones (1928) reports the case of a girl of 18 who, 5 months after removal of a "benign mucous polyp", developed an obvious sarcoma botryoides. Although biopsy did not confirm the malignant nature of the tumour, he advised and performed radical hysterectomy on clinical grounds. The patient died of recurrence 7 months after the operation.

Treatment

The results of treatment have been so bad that a fatal outcome is the rule. Diehl and Haught (1946) went so far as to say that "the prognosis is uniformly poor and the diagnosis is open to question in any case which survives more than 2 years." Recurrence is nearly always local and distant metastases are rare. Of our 2 cases only 1 at autopsy showed very early spread to the para-aortic nodes. Of previously recorded cases, very few had distant spread to lymph nodes or lungs (Willis, 1948).

Because of the low metastasis rate and high local recurrence rate, Meigs (Unfelder and Quan, 1947) and Shackman (1950) have recently carried out radical surgical extirpation. The patients were 26 months and 4 years old respectively. Meigs performed radical hysterectomy by the abdominal route. He conserved the ovaries but divided the vagina very low. With the patient then moved to the lithotomy position he removed the rest of the vagina, conserving only a small area of vaginal skin near the urethra. The child had to be catheterized for 3 months after the operation but subsequently did well. Shackman was even more radical and, having first transplanted both ureters into the colon, he then, about 4 weeks later, carried out perineal resection of vulva, vagina, uterus, urethra, bladder and, to give better access, the right pubic ramus. His article contains a clinical photograph of his patient, alive and well, 2 years after the operation. The cases are both too recent for cures to be claimed but the low general metastasis rate in this condition justifies optimism. Radium and X-rays have been given an extensive trial and have nearly always been followed by rapid recurrence. Shackman could only find 5 cases in the world literature which had survived for as long as 2 years and no information has been published about the end results in these 5. We agree, therefore, that the best hope of curing patients with sarcoma botryoides lies in early diagnosis and radical surgery.

Summary

(1) Two new cases of sarcoma botryoides of the genital tract in children are added to the literature.

(2) Attention is drawn to the extreme rarity of benign polypoid lesions of the vagina and cervix in childhood.

(3) It is submitted that any polypi protruding from the vulva in a child should be diagnosed provisionally as sarcoma botryoides.

(4) In view of the high local recurrence rate and the low metastasis rate, the best hope of cure would appear to be by radical surgery.

We wish to thank Professor Robert Kellar for permission to publish the second case. We are also grateful to our other colleagues who supplied the earlier clinical notes of the 2 cases and to Dr. Agnes MacGregor and Dr. A. E. Claireaux for the autopsy report of Case 2. We are indebted to Mr. J. H. Shearsby, A.M.I.L.T., Chief Technician in the Department, for the photographs.

Addendum

Since this paper was written we have received from Dr. J. V. Meigs a letter dated 31st December, 1952, in which he informs us that his patient, now 6 years after operation, is perfectly well and free from any sign of recurrence.

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THE ONSET OF LABOUR IN RELATION TO THE LENGTH OF THE MENSTRUAL CYCLE

Preliminary Communication

BY

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THE problem of the duration of pregnancy has exercised the minds of obstetricians for centuries and some confusion occurs on account of the different methods of its estimation. The true period of gestation must be from the time the ovum is fertilized to the birth of the baby, but the former event cannot be ascertained accurately and the time taken to expel the infant from the uterus varies in individuals and in individual labours.

Some authors have estimated the interval between fertile coitus to expulsion of the child, but here again there is some inaccuracy.

Naegele's original paper appears to have been lost but his "Rule Due" is still the most generally accepted basis for calculating the date of delivery. Certain modifications have to be made to allow for the different number of days in our calendar months, and modern obstetric tables are made out to bring the expected date of confinement on the 280th day after the first day of the last normal menstrual period. Even if this figure is accepted there is a considerable variation on either side, which, up to date, has not been satisfactorily explained.

Knaus (1949) gives the duration of pregnancy a value of 273 days from the date of ovulation, claiming that release of the ovum always occurs 14 days before menstruation. He stresses the fact that menstruation rarely occurs with any regularity, yet does not explain how the day of ovulation is to be estimated exactly when the menstrual loss, which "fixes" this all important date, does not materialize. He concludes that the span of human gestation is entirely independent of the length and irregularity of the menstrual cycle.

Arnot (1942) analyzing 3,606 pregnancies, found the average duration to be 280.2 ± 10.2 days, and formed the opinion that the onset of labour has some relationship to the length of the cycle. His figures are significantly close to the calculated date but he appears to have taken the average of several cycles at each extreme.

TABLE I (Arnot)

Length of cycle (days)	Average duration (days)	Calculated duration (days)
33–36	282.5	281.6
30	280.74	270
28	283.3	280
26–28	279.61	278.66
26–27	276	278
26	277.8	286
25–26	281.1	280.5
21–25	281.64	279.6

He observes that Naegele's method does not apply if the periods are irregular, quotes Wahl as saying that delivery will be delayed in a large number of cases when the cycle is longer than 28 days and vice versa, and concludes—"most men agree that 280 days is near enough and that actual pregnancy is 14 or 15 days less."

Jolly (1928) suggested a direct relationship between the menstrual cycle and the onset of labour, maintaining that the ovarian cycle continues throughout pregnancy, without ovulation and without menstruation. He quotes 6 cases, 5 of 24-day cycles and 1 of 26 days, where labour started at the end of the 11th cycle $\pm$ 2 days and concludes that this is the

normal, but that longer cycles do not follow this rule " except in the exception ", and that labour then starts at the 10th cycle.

He drew attention to the wide variations in different estimates, quoting Eden and Holland as dating labour to occur 273 days after intercourse, while Williams's figures showed an average interval of 269.91 with a range of 231–329 days.

Riebold (1938) states that labour starts in relation to the length of the cycle and divides women into 5 groups according to their physiological weeks and weekly rhythms. He does not explain how these are to be ascertained. Stressing that one should take into account the date of the onset of labour and not the actual delivery he estimates labour to start as follows:

With a	21-day	rhythm	on the	273rd	day	13 cycles
„	26	„	„	286th	„	11 „
„	28	„	„	280th	„	10 „
„	30.4	„	„	274th	„	9 „
„	36.5	„	„	292nd	„	8 „

but says the date cannot be calculated to within ± 7 days on account of possible " phase displacement during pregnancy."

Karn (1947), discussing prematurity, places the distribution of full-time pregnancy from 247 to 317 days, and Gibson and McKeown (1950) state that in single births the average duration of pregnancy is approximately 281 days (stillbirths excluded), but that of all births 28 per cent are delivered in the 40th week, 65 per cent in the 39th, 40th and 41st weeks, and the remainder (35 per cent) earlier than 266 days or later than 293 days. They find no consistent relationship between the duration of pregnancy and age or parity.

Hotelling and Hotelling (1932), " applying modern statistical methods " to a large series of cases, conclude that 280 days is the average duration of pregnancy if the very long and the very short durations are excluded, with a standard deviation of 11 days, and prove that the differences between the average duration of pregnancies of individuals are significantly greater than the differences between the various pregnancies of each individual. They say that the frequency curve of durations shows that there is some variable factor other than the date of impregnation, a point which will be mentioned again.

Assessing the Menstrual Cycle

In this communication " the duration of pregnancy " is used to denote the number of days between the first day of the last normal menstruation and the onset of labour, and this has been studied with special reference to the length of the menstrual interval.

The generally accepted figure of 280 days is not disputed but an explanation is offered of the wide variations that occur.

Personal observation suggests that women fall into 4 main groups:

(1) Those who go into labour very near the date calculated by Neagele's method.

(2) Those who are consistently early.

(3) Those who are consistently late.

(4) Those in whom there is no regularity.

The idea that this might be due to the variation in the menstrual intervals of different individuals came from the observation that many of the women who were always late had cycles of more than 28 days, a fact already noted by Wahl, and it was decided to examine the menstrual histories of cases under review. It has been shown (Fluhmann, 1934; Goldzieher, Henkin and Hamblen, 1947; Harman, 1942; Knaus, 1949) that there is great variation in the length of the menstrual cycle in different individuals and that absolute regularity in an individual is rare. The range varies from 10 to 100 days, and in a series of 150 women only 15 per cent had a 28-day periodicity.

It has also been suggested (Gunn, Jenkin and Gunn, 1937) that as a woman grows older her cycle tends to shorten and that pregnancy may play some part in bringing this about.

Women are remarkably inaccurate in giving their menstrual histories, and it is, therefore, useless to accept figures from case-papers unless they have been checked carefully. In all the cases in this series the histories have been examined personally and compared with calendars wherever possible—in the absence of a calendar any uncertainty on the part of the patient caused her case to be discarded.

Length of Cycle and Duration of Pregnancy

The first results from attempting to relate length of cycle to duration of pregnancy were disappointing. Women with a 29-day cycle do go about 10 days overdue, but those with a 30-day cycle are sometimes 10 days early and sometimes 3 weeks late. The same was found for short cycles, and the consideration of this revealed a possible solution—that labour might not occur after the same number of cycles in any particular group, nor even in the same individual. Table II was drawn up showing the number of days elapsing between the last menstruation and each menstrual cycle for a range of 21 to 35 days, and the interesting fact emerged that in every case except that of the 33-day cycle there is a date on which menstruation is due to occur within ± 10 days of 280. Could it be that pregnancy lasts for a variable number of "menstrual months" and could this, combined with the variation in the length of the cycles of individuals, be the "other variable factor" mentioned by Hotelling and Hotelling?

Several hundred patients have been interviewed and to date the duration of 303 pregnancies in 205 patients who could produce satisfactory menstrual histories has been studied. The number of days from the first day of the last menstrual period to the onset of labour has been recorded. All the pregnancies were normal, and all were allowed to terminate spontaneously. In order not to confuse the issue with obviously premature births, no case delivered before the 260th day was included but no limit has been placed on those going beyond the 280th day.

All these cases were examined personally during their most recent pregnancy, and where previous pregnancies are included the date of the relevant menstrual period has been ascertained, the expected date of delivery checked on a 280-day table and any change in the menstrual interval noted.

It must be emphasized that the date to which the count is made is that of the onset of labour, not the date of delivery, although they often coincided. In each case a figure has been calculated which is a multiple of the number of days in the cycle and a comparison has been made between this and the duration of pregnancy as defined above.

Figs. 1 and 2 show the frequency distributions plotted by two methods: (A) by the day on which labour started, counting from the first day of the last menstruation; (B) by relating the onset of labour to the end of the appropriate menstrual cycle.

Table III shows the average observed duration compared with the theoretical duration, the number of menstrual months involved, and the number of cases in each group.

Table II

Days on which periods are due for different cycles

Days	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th
21	21	42	63	84	105	126	147	168	189	210	231	252	**273**	294
22	22	44	66	88	110	132	154	176	198	220	242	264	**286**	
23	23	46	69	92	115	138	161	184	207	230	253	**276**	299	
24	24	48	72	96	120	144	168	192	216	240	264	**288**	312	
25	25	50	75	100	125	150	175	200	225	250	**275**	300		
26	26	52	78	104	130	156	182	208	234	260	**286**	312		
27	27	54	81	108	135	162	189	216	243	**270**	297	324		
28	28	56	84	112	140	168	196	224	252	**280**	308			
29	29	58	87	116	145	174	203	232	261	**290**	319			
30	30	60	90	120	150	180	210	240	**270**	300				
31	31	62	93	124	155	186	217	248	**279**	310				
32	32	64	96	128	160	192	224	256	**288**	320				
33	33	66	99	132	165	198	231	**264**	**297**	330				
34	34	68	102	136	170	204	238	**272**	306					
35	35	70	105	140	175	210	245	**280**	315					

TABLE III

Number of days calculated to elapse between the first day of the last menstrual period and the onset of labour, compared with the average number observed for each group.

Days in cycle	No. of cycles	Duration of pregnancy: Expected	Duration of pregnancy: Observed average	No. of cases
21	15	315	309	1
	14	294	294	1
	13	273	272	4
22	13	286	283	4
	12	264	266	1
23	13	299	305	3
24	12	288	287	4
24.5	12	294	295	9
	11	270	273	2
25	12	300	297	7
	11	275	273	12
25.5	12	306	308	1
	11	281	284	2
26	11	286	287	14
	10	260	261	7
26.5	12	292	292	1
	11	265	271	1
27	11	297	296	2
	10	270	271	10
27.5	10	275	274	6
28	11	308	311	2
	10	280	281	73
28.5	10	285	285	20
29	11	319	319	1
	10	290	290	45
	9	261	266	1
29.5	10	295	292	4
	9	266	266	1
30	10	300	299	10
	9	270	268	6
30.5	10	305	305	3
	9	275	278	2
31	10	310	309	6
	9	279	280	16
31.5	9	284	283	1
32	9	288	288	4
32.5	9	293	294	1
33	9	297	295	3
34	9	306	301	2
35	8	280	282	2
35.5	8	284	288	1
42	7	294	296	6
48	6	288	288	1

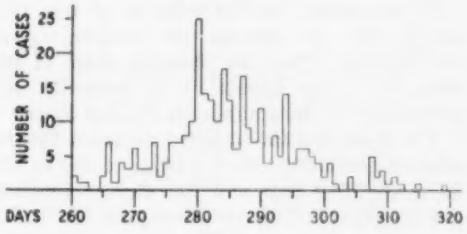

FIG. 1
Day on which onset of labour occurred.

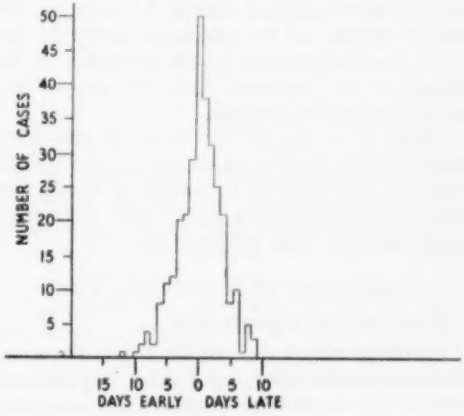

FIG. 2
Onset of labour shown as late or early, in days, calculated to nearest number of cycles.

STATISTICAL SIGNIFICANCE

These figures have been analyzed statistically by Dr. J. W. B. Douglas and Mrs. C. Mogford at the London School of Economics and Political Science. Two hypotheses were tested:

(1) That there is no association between the duration of pregnancy and the length of the cycle.

(2) That the dates of the onset of labour are distributed about the appropriate cyclical dates in accordance with the normal law.

In the first test the correspondence between the observed and expected frequencies gave $\chi^2=260.3$ for 11 degrees of freedom, giving a value of P less than 0.00001 and the first hypothesis may therefore be safely rejected.

In the second test the value of χ^2 was 14.9 which, for 12 degrees of freedom, gives $0.3>P>0.2$. Thus the observed dates of the onset of labour appear to be normally distributed about the appropriate cyclical dates.

The mean and the standard deviation for the original distribution (with a range of 260 to 319 days) are 285.1 days and 10.5 days. Hotelling and Hotelling (1932), with a range of 254 to 319 days, gave figures of 281.4 and 10.7. The standard deviation for the distribution obtained by relating the observed duration of pregnancy to the nearest cyclical date is 3.5 days, i.e. the major portion of the variance, nearly 90 per cent, is accounted for by the difference in the length of the menstrual cycle and the varying number of cycles involved.

While it is beyond the scope of this communication to include all the statistical evidence, there is the intention to publish it later when more data are available, particularly in the very short and very long cycle groups.

Deductions from Available Data

This analysis suggests that:

(1) Pregnancy lasts, not for a given number of days, but for a varying number of menstrual cycles, the number being greater for the short than for the long ones, and not always the same, even in individuals.

(2) The fact that a woman has a short cycle does not imply that her labour will be early, though it would appear that a long cycle predisposes to a long pregnancy. This is slightly at variance with Wahl's opinion.

(3) Individuals with regular cycles are generally consistent in the length of their pregnancies. If there is any marked variation it bears a close relationship to the length of the cycle, and it appears that if labour fails to start at the expected date, pregnancy will probably continue for another menstrual month.

(4) For most groups there are two dates, separated by a menstrual month, on which labour may start, the infant being mature in either case. It is hoped to show in a further communication that premature labours also tend to start at the end of a menstrual cycle, and the time at which abortions occur will be examined critically.

(5) Where the length of the cycle has altered through the years, the duration of pregnancy shows a corresponding change. Case No. 117 had a 28-day cycle before her 1st pregnancy which terminated on the 280th day. Her 2nd and 3rd pregnancies lasted 288 and 293 days respectively, and her 4th, when the cycle had become 25 days, ended on the 299th day compared with a calculated 300 days (12 cycles).

Where the interval is very irregular there is no consistency in the length of pregnancy and it is impossible to forecast the onset of labour with any accuracy. A few cases, not included in the table show this:

Menstrual interval	Duration of pregnancies (days)
Case (*a*) 21–38 days	249, 290, 294, 294, 304, 277, 294
Case (*b*) 16–31 days	282, 74, 84, 263, 273
Case (*c*) 21–28 days	208, 189, 259
Case (*d*) 16–30 days	265, 301, 308, 301

The birth weights have not been recorded but there were no babies which were regarded as really premature. Wrigley (1946) points out that a child may be matured in 38, 39, 40, 41, or 42 weeks, and is not necessarily premature nor postmature, while Calkins (1948) holds that postmaturity does occur and that the baby's weight depends on the size of the placenta.

There are 2 cases of very long pregnancy, not included in the analysis, which are worth considering:

Case 81 was reported by Bensted-Smith in 1941. Labour started 336 days after the last day of the previous menstruation and 330 days after the husband's departure overseas. The birth weight was 8¼ pounds. It was her third pregnancy and both the previous children had been "about a month late." Menstruation had always occurred at 56-day intervals, quite regular and painless. He does not state how long menstruation lasted, but 336 is 6 (56-day) cycles.

Case 206 was observed personally during her 2nd pregnancy. Her interval was also 56 days and the 1st pregnancy lasted 278 days ($5\times56=280$). Her 2nd pregnancy ended spontaneously on the 335th day after a show and "false labour" on the 278th day. When uterine activity ceased then, she was deliberately allowed to continue without induction as the baby did not appear to be unduly large. She was first seen early in the antenatal period and there is

no reason to suppose her dates were wrong. Birth weights of her infants were (1) 6 pounds 13 ounces, (2) 7 pounds 10 ounces.

Dates of 2nd pregnancy: last menstrual period, 2nd May, 1951; expected date of delivery, 6th February, 1952; "false labour", 4th February, 1952 (278 days); onset of labour, 1st April, 1952 (335 days).

Discussion

The idea that the onset of labour may be related to the length of the menstrual cycle is not new, but it does not appear to have received the attention it deserves.

It does not conflict with previous estimates of the average duration of pregnancy but explains, to a large extent, the wide variations found in all analyses.

It in no way impairs the value of observations made on the true period of gestation as it suggests a time for the onset of labour, a very different thing. McKeown and Gibson (1952), in their latest communication on the medico-legal aspect of very long pregnancies, emphasize the importance of establishing the length and regularity of the cycle. They show that the true duration of pregnancy may, in certain circumstances, be many days less than the period of amenorrhoea. They quote 2 cases when the apparent durations were 339 and 359 days and suggest, with some justification, that the true periods of gestation were probably 28–56 and 14–77 days less. These figures are based on the possible times of fertile intercourse and show how unreliable this method of assessing the period of gestation may be when the menstrual interval is very irregular and the date of coitus uncertain.

The theory that gestation lasts for a given time after ovulation is attractive at first sight but it also results in wide variations, although it does help to explain the cases of very long duration. If Knaus's contention that ovulation occurs 14 days before menstruation is applied to the present series the results are inconsistent. The sample is too small for firm deductions to be made in all the groups but the figures for those containing 10 cases or more may be given.

In any case it is not universally agreed that the date of ovulation can be pinpointed, and personal observation shows that it varies considerably, even in individuals with regular cycles.

Table IV

Days in cycle	Observed duration	True duration (Knaus)
25	273	262*
26	261	249
27	271	258
28	281	267
28.5	285	270.5
29	290	275
30	299	283
31	280	263

*273−(25−14) etc.

Most obstetricians agree that in cases of threatened abortion the danger occurs when menstruation is due and in cases of habitual abortion it is the custom to warn a patient that she must rest at those times.

To suggest that full-time labour may also start when a period is due is only to carry this idea to its logical conclusion and it is submitted that this small series shows that the suggestion has some corroboration in fact.

Summary

In this preliminary communication 303 pregnancies in 205 women have been investigated in relation to the length of the menstrual cycle.

The results obtained have been analyzed statistically and suggest that the onset of full-time labour corresponds very closely to the end of the menstrual cycle.

If the length of pregnancy (taken from the first day of the last normal period to the onset of labour) is related to the appropriate cycle, the standard deviation is reduced from 10.5 to 3.5 days.

The investigation is being continued and when more data are available the figures will be re-analyzed.

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HERPES GESTATIONIS
A Report of a Case

BY

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Herpes gestationis is the name given to dermatitis herpetiformis when it occurs during pregnancy or the puerperium. This disease of the skin, about which little has been written in this country, was first described by Bunel in 1811, and since then has been given a multitude of names. The term herpes gestationis was first used by Milton in 1872, and is now the universally accepted term for this complication of pregnancy That herpes gestationis is a rare occurrence can be seen from the statement of Irving (1937) that no patient with this disease was admitted to the Boston Lying-in Hospital in 20 years. In the past 20 years only 2 case reports of herpes gestationis have appeared in the British literature, and for this reason a summary of the literature and a description of an additional case is desirable

In severe cases prodromata are usually present for several days preceding the cutaneous outbreak, and consist of malaise, constipation, febrile disturbance, and alternate hot and cold sensations. Itching is also generally present for several days before any sign of efflorescence, and, even in mild cases, slight systemic disorders may be present. The skin lesions may be gradual or sudden in their onset and development, and not infrequently the rash, accompanied by severe itching or burning, breaks out all over the body in the course of a few days. These itching, burning, and pricking sensations are always present and when the eruption is profuse cause the greatest suffering. Before each fresh outbreak of vesicles the sensations become most intense, abating only slightly when the vesicular lesions rupture. In almost all instances the disease assumes a chronic form and is characterized by more or less distinctly marked exacerbations or relapses, occurring at intervals of weeks or months. The disease usually begins in the 4th or 5th month of pregnancy, but it may first occur before or after this time, or in the puerperium. It may occur in the first or not until a subsequent pregnancy, and in many instances it recurs with each successive pregnancy and as a rule the severity increases with each attack (Sequira *et al.*, 1947). In subsequent pregnancies the disease is likely to occur earlier (Bruns, 1938). All surfaces of the body, the face and scalp, the palms and soles, and the mucous membranes, are liable to be affected. In several of the cases described in the literature, the first area of the skin to show evidence of change was that round the umbilicus.

In a typical case the skin lesions begin as erythematous, discrete papules which enlarge and later may become confluent to form patches with irregularly shaped, marginate outlines. The colour of the lesions varies, being at first bright red, but soon becoming deep red, and the centre of each papule fades. Then the vesicles develop and coalesce to form blebs, tense and rounded, filled with a serous or cloudy fluid, often containing many eosinophils, and they are seated upon a slightly inflamed base. A few bullae may appear on apparently normal skin and these may vary in size from a match-head to a walnut, and are for the most part irregular in outline. The lesions are inclined to appear in crops at irregular intervals and a week may be required for their complete development. In the course of a few days the vesicles generally rupture, and then become covered with a brownish crust. Ulceration occurs following secondary infection or trauma and lymph-node groups may become enlarged and tender. Most chronic skin diseases associated with intense itching display pigmentation, and in this disease it often occurs in the form of narrow rings surrounding the site of each bygone vesicle. It is usually

of a mottled brownish hue and is persistent. In some cases an eosinophilia of 20–30 per cent is present in the blood and indican may be present in the urine, but these two findings are unreliable from the point of view of diagnosis. The patient may be sensitive to iodides and bromides. After the birth of the child, the disease usually improves but there is frequently a relapse during the puerperium. Following this relapse the disease undergoes a remission and by the end of 2 months the patient is usually cured. Tommasi (1924) reported the case where the disease persisted longest — the eruption recurring with each menstrual period for 18 months.

The prognosis for the mother is usually good, although several articles on herpes gestationis have contained reports of fatal cases. According to Kaposi (1883), 4 out of 5 of Hebra's cases died and 10 out of 11 cases observed by him were fatal. Duhring (1884), on the other hand, in his series of cases had no deaths and in the last 20 years there is only 1 report of a fatal case. It seems likely that the fatal cases of earlier authors were due to secondary infection, and now with many new chemotherapeutic agents available it should be rare for a patient with herpes gestationis to die.

Cutaneous lesions may occur in the child but the prognosis is also good. Milton (1872), Tommasi (1924), and Willi and Burckhardt (1941) described cases of newborn infants with herpetiform vesicles. The disease sometimes lasted 6 months but despite the extensive skin lesions the babies gained weight and progressed normally. Mueller and Lapp (1944) state that the incidence of abortions, congenital abnormalities, and stillbirths is high amongst women suffering from herpes gestationis, but a survey of the past literature has not confirmed this, and in many cases the reason for the stillbirths was undoubtedly obstetric. Only 2 cases of congenital malformation are described and in these there was no note of the time of onset of the herpes. The abnormalities described were microphthalmus and anencephaly. In the reported cases where the disease was present at the 2nd or 3rd month of pregnancy there is no note of any congenital abnormality occurring in the infant.

The first suggested cause of herpes gestationis was that of a toxaemia. The cutaneous lesions were said to result from injury to the vasomotor nerves by toxins produced by ferments from foetal tissues or from chorionic villi. Where the disease occurred for the first time in the puerperium the retained placental tags were held to be responsible. More recently, reflex causes, focal infection, and hormonal imbalance, have all been incriminated. Tommasi (1924) suggested that the disease was due to ovarian hypofunction; Sechi (1932) employed corpus luteum hormone in the treatment of a case and noted immediate regression of the eruption and an acute postpartum exacerbation was likewise immediately controlled; Weidman (1938) noted that the degree of pruritus varied with fluctuations in the gonadotrophic principle, there being a greater quantity in those with mild pruritus and a lesser amount in those with severe pruritus; Turner and Zakon (1941) treated their patient with oestrogen but this failed to have any effect on the progress of the disease. Keaty *et al.* (1951) estimated the chorionic gonadotrophin in cases of herpes gestationis and in 7 of their 10 patients the level of serum chorionic gonadotrophin was abnormally high during late pregnancy, and they concluded that an imbalance in the production or metabolism of the hormones of pregnancy was responsible for this disease.

A relationship between hormones and the occurrence of the dermatosis in the pregnant state has been suggested in dermatological and obstetric literature by such findings as persistent thymus and pituitary and other changes (Carter and Pearse, 1937).

An attempt to demonstrate a virus in a case of dermatitis herpetiformis was made by Bedson (1935), but he was unable to prove that an infective agent was present in the fluid from bullae. Likewise Brain (1936) was unable to prove the presence of a virus in 4 cases of the same disease by means of antigen-antibody reactions. Subsequent attempts to isolate a virus have also been inconclusive.

This disease is notoriously stubborn and treatment does not seem in most cases to influence its course. Treatment is mainly symptomatic and designed to alleviate symptoms and to limit secondary infection. When sedation is required, bromides should be avoided in view of possible

FIG. 1

FIG. 2

These photographs show the typical bullae of *Herpes Gestationis*.

sensitivity. Incision of the bullae and daily permanganate baths have been stated to afford considerable relief. Sulphathiazole in small doses (1 g. daily) maintained over a period of a month was reported by Lewis (1942) to have produced amelioration of subjective complaints, but sulphapyridine in small doses was preferred by Costello (1947). Progesterone has been tried by several authors, but Tommasi (1924) considered that it had no influence. On the other hand, Kampf (1940) considered that corpus luteum extracts lessened the pruritus and caused the eruption to regress slowly. Likewise Keaty *et al.* (1951) administered 25–50 mg. daily and considered that there was a definite remission in all 10 cases. Van Vonno (1947), who claims to have seen 23 cases, treated them all with desoxycortico-sterone-acetate (DOCA). He gave 5 mg. 3 times weekly and noted marked improvement in 14 and some improvement in a further 6 cases. Penicillin has been said to help temporarily but the patients of Carpenter and Hall (1945) relapsed when it was stopped. Thorne (1951) reported rapid and dramatic improvement in a severe case of dermatitis herpetiformis when the patient was given 1 g. of chloromycetin 5 times a day for 2 days followed by 0.25g. 5 times a day for 4 days. Under this treatment the clinical condition of the patient improved steadily, the old lesions dried up and only a few further transient vesicles appeared.

Clayton and Oram (1951) in a brief review consider that therapeutic abortion is indicated only where the patient is being driven to suicide by irritation of the skin. The danger of introducing infection is very high and any surgical procedure should not be entered upon lightly. Only 3 cases are reported where Caesarean section was employed. The indication for the first operation was the increasing severity of the herpes gestationis (Gellhorn, 1933), while the second and third operations were undertaken because of disproportion (Carter and Pearse, 1937; Keaty *et al.*, 1951). Two patients developed peritonitis on the 4th postoperative day and 1 died.

Report of a Case

Mrs. E. C., aged 30, was admitted to hospital on 25th February, 1952. She stated that 6 weeks before admission she developed near the umbilicus a pimple which became vesicular and enlarged. The affected area was intensely pruritic. The breasts were affected in several days, and the rash then spread in crops all over the body. One week after the onset she developed small vesicles in her mouth; these lasted only a few days. The pruritus was most intense just before the appearance of the vesicles.

At the time of admission she was 36 weeks pregnant and inquiry into her past history revealed no serious illness and no history of any allergic disease. Her single previous pregnancy had been uneventful and at term she had been delivered by forceps of a live infant. Over the whole surface of her body were herpetiform lesions in various stages of development, the bullae being most marked over her forearms, abdomen and legs. Some of the bullae which varied in size from a match-head to a walnut were seated upon an erythematous base, while others appeared to have arisen from normal skin. The vesicular lesions on the patient's back and chest had burst and these areas were covered by brownish crusts. Her arms and legs were grossly oedematous.

Physical examination revealed no other abnormality; her blood-pressure was 140/95; the only abnormal constituent in her urine was indican which was present in moderate amount; examination of the fluid from the bullae showed no eosinophils to be present; a blood count revealed that she had a leucocytosis of 15,400 per c.mm. with an eosinophilia of 10 per cent; the Wassermann reaction was negative; the plasma proteins showed a considerable diminution — albumin + globulin 4.8g./100ml., albumin 2.71g./100ml., globulin 2.09g./100ml., giving an albumin/globulin ratio of 1.3:1; cultures of material from the lesions on developing chick embryos failed to show the presence of a virus.

A biopsy was performed on the skin of an affected area and the specimen was submitted for histological examination. The pathological changes in the corium were dilatation of the vessels and oedema with lymphocytic and eosinophilic infiltration, particularly perivascular. In an area where a vesicle had appeared the oedema was more marked and the vesicle contained cellular debris, fibrin, and many eosinophils.

Despite treatment, the disease spread and the patient became depressed and wept frequently. When 37 weeks pregnant she went into labour and after a short labour of 5 hours she delivered herself of a live infant. The day after delivery there were numerous fresh bullae over the chest, breasts, hands, neck, thighs, and feet, and, in view of the multiple lesions over the breasts, lactation was suppressed by oral stilboestrol. Despite further attempts at treatment the bullae continued to appear. Before the appearance of each crop the patient experienced shivering attacks and noted a prickling sensation in the area where the lesions eventually appeared. Three weeks after delivery the bullae became frankly pustular and the patient had a pyrexia of 100.6° and a tachycardia of 116. She remained pyrexial for 3 days when the infection was ultimately controlled by chloromycetin. The end of the course of chloromycetin coincided

with the appearance of the last crop of vesicles and thereafter a spontaneous cure occurred, and within a week a marked improvement was noticed. Fourteen days after delivery the blood showed an eosinophilia of 4 per cent. Prior to discharge, on 6th April, 1952, the lesions had healed completely but there was considerable light brown pigmentation of the face, arms, and legs. Local treatment consisted of incision of the bullae, permanganate baths, and the application of 1 per cent phenol in calamine. A course of sulphapyridine (½ g. 4 times daily) lasting 6 days was given, but under this treatment the patient's condition became worse. Following this a course of anti-histamines (Histantin) was given without effect. Chloromycetin also had no effect, except when the lesions became frankly pustular, due to secondary infection.

The patient was seen twice after discharge from hospital. She had had 2 menstrual periods and at the time of these the herpetiform rash again appeared. Each of these subsequent attacks lasted a week.

The infant was born with 2 herpetiform lesions on his chin. By the next day there were fresh lesions over the eyes and, in order to try and avoid any infection of the eyes, chloromycetin was given to the child. Within 4 days the lesions were healed and the apparent response of the lesions to chloromycetin was considered to be fortuitous. The further progress of the infant was uneventful. A blood count the day after birth showed an eosinophilia of 4 per cent but within 10 days the differential white cell count was normal.

Summary

(1) The literature on the aetiology, symptomatology, and treatment of herpes gestationis has been reviewed.

(2) Attention has been called to the paucity of reports on such cases in Britain as compared with their more frequent occurrence in other countries.

(3) A description of the disease in a mother of 30 years of age and her infant are given. The disease started in the mother in the 7th month of pregnancy and spontaneous cure occurred 1 month after its termination. In the infant the disease disappeared within 1 week after birth.

(4) An attempt to obtain a virus from the lesions was unsuccessful and it is not possible to suggest what the aetiological factor can be.

(5) Figs. 1 and 2 show the typical characters of the lesions.

The author is indebted to Dr. A. Macdonald, The Department of Bacteriology, The University of Liverpool, for attempting to culture a virus, and to Professor G. G. Lennon for permission to publish this case.

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FURTHER OBSERVATIONS ON THE EFFECT OF DIHYDRO-ERGOTAMINE UPON HUMAN UTERINE ACTION

BY

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SINCE 1948 a considerable amount of evidence has been produced to show that small doses of dihydroergotamine exert a beneficial effect upon the progress of many prolonged labours due to uterine dysfunction (Sauter, 1948; Reist, 1949; Gill, 1951; Gill and Farrar, 1951). In an earlier communication we stated "we believe that the drug is safe, used as we have used it; but only when many more patients have been treated can there be absolute certainty on this point" (Gill, 1951). Since then our experience of the drug has trebled and its use is now general in several other large Australian hospitals. We are amply satisfied that the safety of the drug is proven, *providing that the dose does not exceed* 0.25 *mg. given by the intramuscular route.*

Since the use of dihydroergotamine has been accepted at King George Vth Hospital, Sydney, the incidence of prolonged labour has been much reduced. In a series of 2,500 unselected consecutive deliveries immediately prior to the introduction of the drug, 52 of the labours (2.08 per cent) exceeded 48 hours in duration. In a similar random series a year later, the number of such cases was 23 (0.92 per cent), a reduction which is statistically significant. These figures include all admissions irrespective of the duration of labour at the time of admission. There has been no other alteration in hospital routine to account for such a change. The performance of Caesarean section on account of inco-ordinate action of the uterus is becoming a rarity, but it still has a definite place, especially when other factors, such as the age and fertility of the patient, are to be considered.

We are not satisfied, however, that the mode of action of the drug is fully understood. If the action is simply that of blocking adverse effects produced by an adrenergic mechanism, why should the results vary so much from patient to patient? In some, the principal effect appears to be a lowering of uterine and cervical tone as maintained by Sauter (1948), but in others, at least on clinical observation, it appears to be an increase in the contractions themselves accompanied by slow, even dilatation of the cervix. In others both effects are seen, and in about 20 per cent of our cases there is no significant change.

Two obvious variable factors are the cause of the uterine dysfunction, of which we know little, and the response of the individual to a fixed dose of any drug, especially one affecting the autonomic nervous system. In the treatment of vascular disorders the appropriate dose of such an agent is determined by trial and error, a method scarcely possible in obstetric practice. The use of dilute intravenous drip administration is one way of overcoming this difficulty, the alternative being to administer double the dose a few hours later should the initial response be minimal. We have used this method in a few cases, but in one the second response was rather excessive and we discarded the technique. We have given dilute intravenous infusions along with pitocin to some 14 cases of atonic inertia with satisfactory results, but we feel that such infusions are rarely necessary. It is difficult to explain why in several instances, when we have given two doses of 0.25 mg. of dihydroergotamine to a patient, the response to the first has been slight whilst the second dose has seemed highly successful. This does not appear to be related to the degree of dilatation of the cervix. However, we know little of the endocrine and other factors controlling labour and can point

out that the same may be said of attempts to induce labour.

The work of various investigators on the pharmacology of the drug in the rat, rabbit, dog and guinea pig has already been summarized (Gill and Farrar, 1951). In these animals the drug is a moderately powerful adrenergic-blocking agent, has no uterine stimulating effect and, in some animals at least, opposes the uterine effect of the ergot oxytocics. Its toxicity is low and peripheral gangrene is not produced. In the human the anti-migraine effect has been clearly demonstrated; toxicity is low, but vomiting is not infrequent. It has been assumed that the animal findings apply also to the human, and it has been suggested that dihydroergotamine is the drug of choice when migraine is associated with pregnancy, though Tillgren (1947) reports a case of miscarriage at 6 months which he attributes to the use of the drug. In Case No. 4 of our earlier series (Gill and Farrar, 1951) frequently recurring, powerful contractions followed its administration during labour and it is significant that Sauter (1948) reduced the dose from 0.5 mg. to 0.25 mg. because of similar responses. This suggests that in sensitive individuals or following large doses marked stimulation of uterine activity may occur—an effect which is obviously not the same as the anti-spasmodic, tone-diminishing effect which is more usual. Whether this is also due to blocking of adrenalin is doubtful.

Our experience of excessive responses is fortunately limited to the one case. We also have the case history of a patient, not under our care, to whom a dose of 0.5 mg. was given. A dramatic but alarming response occurred but no harm ensued. Sauter (1948) speaks of several and Reist (1949) of at least 2 more when doses of 0.5 mg. were used. Chassar Moir (1951) tells me of a patient who was inadvertently given a dose of 1.0 mg., anaesthesia being necessary to control the contractions. In all these cases the foetus has survived, perhaps because of the anaesthesia, but this would appear to suggest that there was no great increase in uterine tone.

Our first approach to the problem of elucidating the action of the drug on the human uterus was the taking of tocographic readings of the upper and lower uterine segments during labour. It was soon apparent this method would not yield the desired information. Tracings must be continued for several hours and the hyper-aesthetic, unco-operative woman in inco-ordinate labour is not a suitable subject. She complains, becomes restless and begs to be left alone. As we are dealing with emotional effects this alone prejudices the findings. Uterine obliquity also presents a problem, as the use of a binder also prejudices the results. Sauter (1950) has recently written of similar problems in the use of the tocograph.

Accordingly it was decided that the effect on the puerperal uterus would be studied using a hydrostatic bag. Despite evident disadvantages the method has been successfully employed in the investigation of the pituitary and ergot oxytocics (Moir, 1932, 1944; Bourne and Burn, 1927; Gill, 1947). The method was based on that used by Moir (1944), excepting that a piston kymograph was used for recording instead of a mercury manometer. No time record is shown but all tracings were taken at a speed of 36 inches per hour.

Tracings were taken from some 30 volunteer puerperal patients, either on the 6th or 7th day of the puerperium. In three tracings the bag appeared to be in the lower uterine segment; only one of these yielded any useful information. In another case the patient complained of palpitation and nausea after receiving 2 units of pitocin and this tracing was abandoned, being only of slight value. The remaining 26 tracings were satisfactory.

The effects of pitocin, ergot and methyl-ergometrine on the puerperal uterus are already well known (Moir, 1932, 1944; Gill, 1947), but 9 more tracings of these effects were taken for comparison. Typical examples are seen in Fig. 1. To 2 of these patients, when the contraction patterns following ergometrine and methylergometrine were well established, 0.5 mg. of dihydroergotamine was given to demonstrate inhibition, if any, but this was not seen. Dihydroergotamine in doses of 0.25 mg. and 0.5 mg. was given by intravenous injection to 10 subjects with a bag in the uterus and when the uterus was not influenced by any previously given drug, and to a further 3, one of whom was studied 4 hours later and the others 8 hours

later. The effect of Priscol was studied on 6 subjects and of Piperoxane (933F) in a further 3.

The response to dihydroergotamine (13 *tracings*)

This response is difficult to understand. In 3 cases there was little or no effect. In 4 there was slight, brief increase in the contractions, or weak contractions appeared when the uterus had been inert; in all 4 the effect was definite but slight and would probably not be sufficient to be observed clinically. In Case No. 20 (Fig. 2b), regular increasing contractions of amplitude comparable to those caused by pitocin appeared and continued for 30 minutes. They were of short duration and the uterus relaxed fully in the intervals. In Cases No. 4 and 8 (Fig. 2a), there were profound effects after delays of 6 and 2 minutes; extremely powerful contractions followed, in Case 4 more powerful than the kymograph could record. These contractions were intermittent, in Case No. 4 lasting some 2 minutes and occurring at intervals of 5 to 8 minutes, whilst in Case No. 8 they were of shorter duration, but greater frequency. In neither was there any diminution in the effect when the graph was discontinued after three-quarters of an hour.

It was then found that in those cases to whom dihydroergotamine had been given the response of the uterus to ergometrine and methylergometrine was much reduced, sometimes entirely absent, and in 3 instances was reversed, the response being inhibitory. If there was any response at all, it was of weak amplitude, short duration and sometimes delayed in its onset.

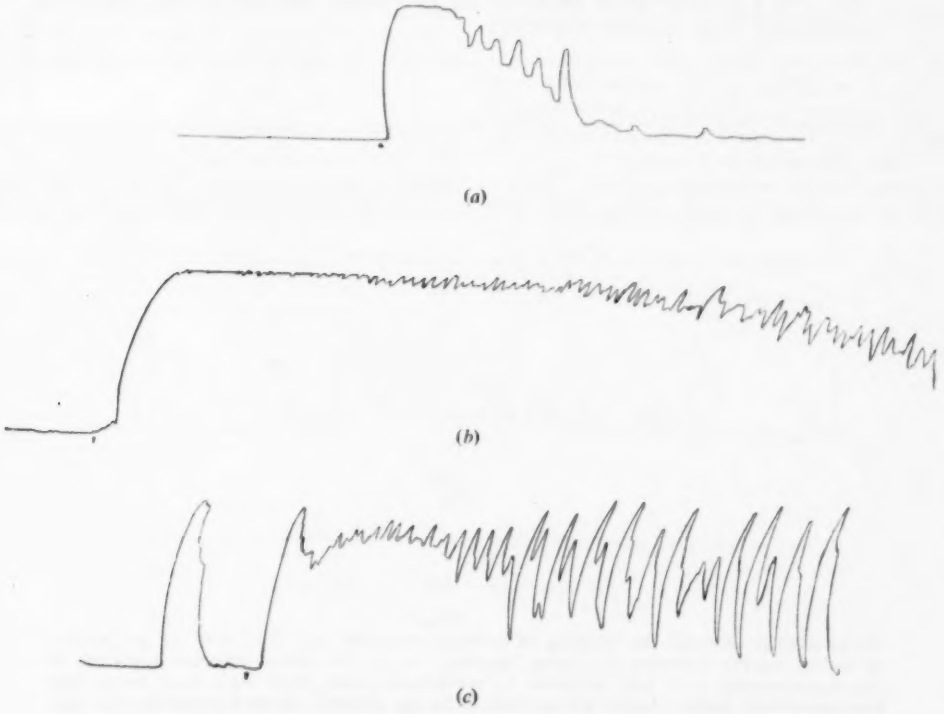
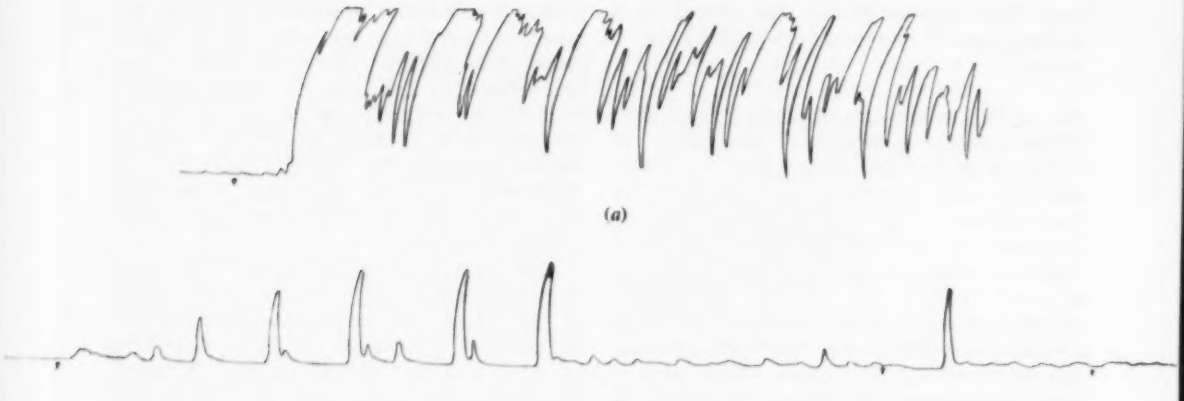


FIG. 1

Examples of typical responses to the oxytocic drugs given by intravenous injection. (*a*) Pitocin, 2 units. (*b*) Ergometrine, 0.125 mg. (*c*) Methylergometrine, 0.05 mg.

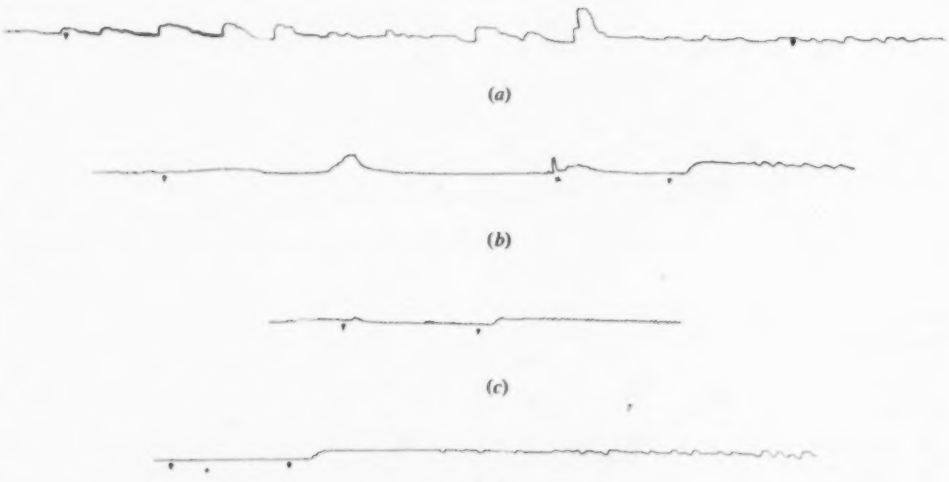


(*a*)

(*b*)

FIG. 2

These tracings illustrate the oxytocic effect of dihydroergotamine (0.5 mg.) which is sometimes seen. Fig. 2 (*b*) also shows at the second and third arrows inhibition of methylergometrine (0.1 mg.) and pitocin (2 units) respectively.



(*a*)

(*b*)

(*c*)

(*d*)

FIG. 3

These tracings illustrate the blocking of oxytocic responses, but show little or no increase in uterine activity following the initial injection. In (*a*) the arrows represent injections of dihydroergotamine (0.25 mg.) followed by methylergometrine (0.05 mg.), there being little response to the latter. In (*b*) ergometrine 0.125 mg. follows dihydroergotamine 0.25 mg., x being an artefact. In (*c*) the first arrow represents Priscol 10 mg. and is followed by a slight contraction, but the response to a subsequent injection of methlyergometrine 0.1 mg. is minimal. In (*d*) Piperoxane 10 mg. was given and was followed by flushing but no uterine activity. A weak contraction followed when ergometrine 0.125 mg. was given 5 minutes later.

The inhibition of the effects of ergometrine (7 tracings) and methylergometrine (2 tracings) appeared to be identical and was evident in all 9 graphs. It was shown after as short a period as 16 minutes and as long a period as 8 hours.

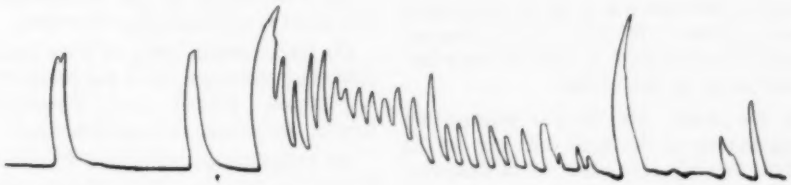
One tracing was taken after 3¾ hours, the effect being one of reversal, and 2 after a period of 8 hours. In the first of these, Case No. 14 (Fig. 4a), there was a powerful response 105 seconds after the injection, equal in amplitude to the average response to 0.125 mg. of ergometrine, but the effect was of unusually brief duration, being complete in 9 minutes. In the second case the effect was mildly inhibitory and a subsequent injection of pitocin was without effect. The question of inhibition of the response to pitocin is less clear, but it seems to be at least partial. This was studied in 5 cases, including the case mentioned above showing no effect after 8 hours delay. In Case No. 2 the response to pitocin was typical, in 2 cases it was only slight and in 1 instance there was no response at all.

The effects of other adrenergic-blocking agents

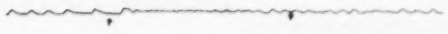
For comparison the effects of 2 other adrenergic-blocking agents were studied briefly, Priscol and Piperoxane (933F). The effect of the latter drug was studied in the cat by Ross (1937), who demonstrated that the uterine response to circulating adrenalin was blocked by it, but not the response to stimulation of the peripheral ends of severed hypogastric nerves. Little is known of the effect of Priscol upon the uterus except that, apart from its adrenergic-blocking effect, it stimulates most plain muscle to a greater or lesser extent.

On the whole the effects of Priscol (6 cases) were similar to those of dihydroergotamine. Injection of the drug was followed in 3 cases by a uterine contraction, the effect coming on in 45 to 90 seconds (1 tracing was unsatisfactory technically, so this means 3 out of 5). It seems probable that this is a direct effect on the uterine muscle. Inhibition was less consistent and in 1 case the subsequent response to ergometrine was at least equal to average and may be regarded as typical, whilst in another the second response to pitocin, Priscol being given between the 2 injections, was only slightly less than the first. Two other curves showed inhibition of pitocin, 2 of methylergometrine and 1 of ergometrine, but the effect seems less, *at least employing a dosage of* 10*mg*., than that of dihydroergotamine.

Only 3 tracings were taken using Piperoxane. The effect of this drug is known to be brief,



(*a*)



(*b*)

FIG. 4

These demonstrate that the blocking effect is prolonged for approximately 8 hours. Each patient had been given dihydroergotamine 0.5 mg. 8 hours previously. Ergometrine 0.125 mg. was then given and in (*b*) 2 units of pitocin were given subsequently. In (*b*) the response to ergometrine, if any, is inhibitory and to pitocin negligible. In (*a*) the response to ergometrine is delayed (105 seconds) and was complete in 9 minutes instead of lasting for almost an hour.

lasting less an hour. In no case was there any effect on the uterine contractions. A subsequent injection of ergometrine gave a powerful response in one case, a moderate response in one, and a mild response of low amplitude in the third. Pitocin was given once and was followed by a rather more prolonged effect than usual.

It must be remembered that these findings apply to the puerperal uterus, and one must be cautious before assuming that the effects during and immediately after labour are the same. On the other hand, clinical experience has confirmed that studies of oxytocic drugs previously made in this way have proved applicable during labour. Only by careful clinical observation can we determine whether these inhibitory effects will interfere with our use of oxytocic drugs in cases of haemorrhage. Certainly in our experience postpartum haemorrhage has rarely been seen in patients who have been given dihydroergotamine and has appeared to respond to ergometrine given intravenously.

One can sum up the apparent effects of dihydroergotamine thus:

(1) In the dosage used there is usually little effect on the uterine contractions, but in a few cases there is a marked increase in the contractions, which, unlike that due to pitocin and ergot, is not tonic in pattern. Whether the use of larger doses would produce such a pattern more frequently has yet to be determined.

(2) On the sixth day of the puerperium dihydroergotamine in doses of 0.25 mg. to 0.5 mg. inhibits the oxytocic effect of ergometrine and methylergometrine, such inhibition occurring within 15 minutes and being still in evidence after 8 hours.

(3) A similar but less consistent inhibition of pitocin has been demonstrated.

(4) Once the response to an ergot oxytocic is evident, it is not affected by the injection of 0.5 mg. of dihydroergotamine.

(5) The blocking effect appears to be associated with the adrenergic-blocking property of the drug, as a rather similar effect can be demonstrated using Priscol, though the effect of Piperoxane is less definite.

Discussion

The variability of the response to dihydroergotamine is still rather obscure. It is possible that had larger doses been used the stimulating effect might have been seen more often, but the variations may be due to other causes, as, for example, the state of the receptors in the uterus or the endocrine balance of the individual. The varying response of the individual to any one dose of such a drug is well known to the physician. It has been clearly shown, however, that, contrary to the belief of Sauter (1948), increased contractions can occur, at least in some individuals. This was suggested by Reist (1949) and by Gill and Farrar (1951) as result of their clinical observations, but was not demonstrated by Sauter using the Frey tonometer. However, this increase in the contractions is always intermittent and never tonic, and in no way resembles the pattern produced by the ergot oxytocics. Thus foetal embarrassment, if produced at all, would be minimal and this is in agreement with our clinical experience.

Summary

(1) Further evidence of the value of dihydroergotamine in delayed labour due to uterine dysfunction is presented.

(2) Theories as to the mechanism whereby this effect is produced are discussed.

(3) Experiments, using an intra-uterine hydrostatic bag technique, as to the effects of dihydroergotamine, Priscol, and Piperoxane upon human uterine activity, are described.

(4) Dihydroergotamine and Priscol are shown to exert a blocking effect against the oxytocic property of ergot and pitocin, but no antagonistic effect if the oxytocic is given first.

(5) In some individuals, at least, uterine activity is increased considerably following administration of dihydroergotamine.

I would express my thanks to Professor Thorp, Professor of Pharmacology at the University of Sydney, for his advice in technical matters, to the Honorary Medical Staff of King George Vth Hospital for providing access to the necessary clinical material, and to the Nursing Staff of the Hospital for their willing help.

Postscript

Since this paper was written Altman, Waltman, Lubin, and Reynolds (1952, *Amer. J. Obstet. Gynec.*, **64**, 101) have investigated the action of dihydroergotamine on some 30 patients using the Reynolds tokodynamometer. They report that the drug stimulates uterine action, increasing both the strength and frequency of contractions, and that it can initiate contractions in an inert uterus. They also report that it lowers uterine tone. In general these findings are in agreement with our own. However, in their series of 20 cases there were 5 foetal and neonatal deaths and 6 other cases of foetal distress. They also record 3 cases of haematuria and 3 of nausea.

It must be pointed out that they administered the drug as an intravenous infusion, dihydroergotamine 1.0 mg. in 500 ml. of distilled water being given in 2 to 4 hours. The tragic results serve to emphasize what we have already stressed, that the smallest effective dose should be used. In our experience, the drug is then safe. It is as illogical to condemn dihydroergotamine because of these results as it would be to-day to condemn pitocin because of the dangerous effects observed when pituitrin was given in huge doses 25 to 30 years ago.

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MENSTRUAL CHARACTERISTICS OF WOMEN LIVING IN A TROPICAL CLIMATE

BY

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STANDARD textbooks state that menstrual characteristics are influenced by race and climate (Curtis, 1946; Shaw, 1948; Baird, 1950). On the other hand neither Elgood (1909), who investigated Eygptian girls, nor Kark (1943), who investigated Bantu girls, found any evidence that race affected the age of the menarche; and Lahille (1917) found that menstrual loss in European women was not influenced by residing in a tropical climate. No account was found, however, in the available literature of a comprehensive survey of menstrual characteristics of women living in the tropics and the present investigation was undertaken to obtain such information.

MATERIALS AND METHODS

The subjects of the inquiry, all of whom lived in Singapore, were students, nurses, and members of various women's organizations. They were asked to fill in the following details on a form: age; age at which menstruation first began; length of stay in the tropics; dates on which menstruation was present; number of pads used each day; symptoms which accompanied menstruation. It was stressed that entries should be made daily during the time that menstruation was present. Eighty-eight forms were returned but 2 were rejected, 1 because the subject stated that she was receiving " hormone injections ", and the other because she had just recovered from amenorrhoea of several years duration. The subjects were 27 " Europeans "—Americans, Australians, and English—(32 per cent), 47 Chinese (54 per cent), and 12 other Asians—Eurasian, Indian, and Indo-Chinese—(14 per cent). All belonged to the higher social levels, and it was thought that the present group resembled those investigated by others in temperate climates (Allen 1933; Fluhmann, 1934; McCance, Luff, and Widdowson, 1937).

The duration of the menstrual flow was taken to be the number of days on which pads were used, and the menstrual interval the number of days from the first day on which a pad was used at one menstruation to the first such day of the next menstruation. The age of the subjects ranged from 18 to 51 years, but 75 per cent were below the age of 30 years. The Asian subjects had lived in the tropics all their lives. Twenty-five Europeans had lived in the tropics for 1 to 32 years, and 2 had arrived within the previous 2 months.

RESULTS

Age of the Menarche

The Europeans were not living in the tropics when their menses first began and consideration of the age of the menarche was confined to the Asian group. One Asian subject did not report this detail and the mean age of the remaining 58 Asians was 13.6 years. No adjustment of the age of the Chinese was necessary because, in common with other Asians in Singapore, they base their age on the Roman calendar and not on the Chinese calendar.

Amount of Menstrual Blood Loss

It was not possible to make direct measurments of the menstrual blood loss, but an indirect estimation was made from the number of pads used. The greatest number was used at the beginning of menstruation; the highest daily average was 3.25 pads per subject and this was on the second day (i.e. the first whole day of bleeding). The greatest number of pads used by any one subject on one day was 10, and the mean number used during one menstruation was 11.49 pads per subject.

Duration of Menstrual Flow

In 11 of the 149 menstruations recorded by 86 subjects a slight mucoid or blood-stained discharge was reported on the day before a pad was used. It was thought, however, that such a discharge did not represent true menstrual loss, which by definition is a discharge of blood. The duration of menstruation was taken to the nearest whole day, as information about the hour at which menstruation began and ceased could not be obtained. The mean duration of flow was 5.44 days for Europeans and 4.79 days for Asians. The difference between these mean values was statistically significant (Table I).

TABLE I

Duration of Menstrual Flow in 86 Women Living in Singapore

Race	Number of menstruations	Mean duration (days)	Range (days)	S. D.	S.E. of mean	"t"	P
Asian ...	99	4.798	3–8	1.3590	0.137	3.26	<0.01
European ...	50	5.440	3–7	0.7698	0.108		

TABLE II

The Length of the Menstrual Interval of 58 Women Living in Singapore

Race	No. of cycles	Mean length of cycle (days)	Range (days)	S. D.	S.E. of mean	"t"	P
Asian ..	40	30.05	20–56	7.943	1.255	0.202	0.8–0.9
European ...	23	29.69	23–41	9.690	2.20		
Whole group ...	63	29.92	20–56	7.739	0.108		

The Length of the Menstrual Interval

The mean menstrual interval for the whole group was 29.92 days. The difference between the mean length of the cycle for Asians and for Europeans was not statistically significant (Table II). The frequency distribution of the individual menstrual intervals is shown in Fig. 1.

Menstrual Symptoms

Eighty-one subjects (94 per cent) reported symptoms associated with menstruation. These symptoms were usually mild, such as "general tiredness" or "slight tingling in the breasts"; but in 13 subjects (15 per cent) they seemed of some severity, for example, "severe pain in the lower part of the abdomen" and "severe headache". Symptoms were most commonly present during the first day or two of menstruation, but 33 subjects (37 per cent) also reported their presence before the onset of flow.

DISCUSSION

Age of the Menarche

The age of the menarche could not be accepted as wholly reliable as it was based on memory. However, all the Asian subjects were below the age of 30 years and likely to remember this event with reasonable accuracy. Several of them reported the age in years and months, which suggested that they had kept some record of the date. In a reliable investigation Wilson and Sutherland (1950) found that the mean age of the menarche of a large group of girls living in England was 13.49 years. The difference between this figure and that found in the present inquiry was not statistically significant ("t" $=0.436$, $P=0.6$ to 0.7). It seemed probable, therefore, that the age of the menarche of Asians in Singapore was the same as that of Europeans in England.

Amount of Menstrual Blood Loss

The number of pads used during menstruation is controlled not only by the amount of menstrual discharge, but also by the fastidiousness

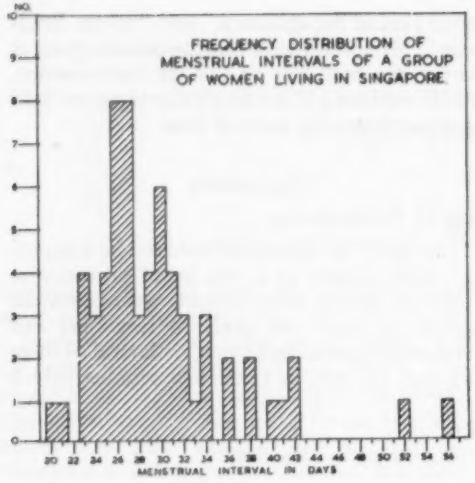

FIG. 1

of the individual, discomfort due to sweating and other factors. For this reason a great deal of reliance could not be placed on such a method of assessing the amount of blood lost. The mean number of pads used for one menstruation, however, was almost the same as that found by Millis (1951) in Australia, and was within the range found by Allen (1933) in America. There was, therefore, no evidence that menstrual losses were affected by living in a tropical climate.

Duration of Menstruation

In the present investigation the duration of flow was practically the same for Asian subjects as that found in England by McCance *et al.* (1937); but the Europeans had a longer duration of menstruation. This suggested that change of residence from a temperate to a hot climate might cause a slight increase in the duration of menstruation, but a more extensive investigation would be necessary to prove this.

The Length of the Menstrual Interval

The length of the menstrual interval found in the present investigation was similar to that found by most investigators who used reliable methods in temperate climates, except that McCance *et al.* (1937) found a somewhat shorter interval in one group of subjects (Table III). The balance of evidence favoured the conclusion that the menstrual interval was the same in the tropics as elsewhere.

Menstrual Symptoms

Symptoms were more frequent in the present subjects than is generally accepted as normal (Baird, 1950), but it is not justifiable to draw further conclusions about purely subjective phenomena of this sort.

SUMMARY

An investigation of the menstrual characteristics of 86 women of different races living in Singapore was made by means of day-to-day records and a questionnaire.

The age of the menarche of Asian subjects was apparently the same as that of girls living in England.

The number of pads used did not suggest that menstrual loss was affected by climate.

The duration of flow was the same for Asians as that for women living in a temperate climate; but that for Europeans living in Singapore was slightly longer.

The length of the menstrual cycle was not affected by living in a tropical climate.

TABLE III

Comparison of the Mean Menstrual Interval of Women Living in Singapore with that of Women Living in a Temperate Climate

Author	Year	No. of cycles	Mean interval (days)	"t" (compared with present group)	P
Fluhmann	1934	747	30.40	0.452	0.6 –0.7
McCance *et al.*	1937	780	27.54	2.42	0.02–0.01
McCance *et al.*	1937	120	27.98	1.913	0.1 –0.05
Haman	1942	2460	28.40	1.550	0.2 –0.1
Present group		63	29.92		

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COMBINED FULL-TIME INTRA-UTERINE AND EXTRA-UTERINE PREGNANCY WITH SURVIVAL OF MOTHER AND BOTH CHILDREN*

BY

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SIMULTANEOUS extra-uterine and intra-uterine pregnancy is not altogether uncommon and about 400 cases have been reported in the medical literature. But both the pregnancies going to term and terminating in live birth is indeed very rare. As many obstetricians with years of experience may never have come across such a case, the following case may be of interest.

REPORT OF A CASE

Mrs. M. B., a Bengali, Hindu woman, aged 27 years, was admitted to the Silver Jubilee Maternity Ward of the Howrah General Hospital at 10 a.m., on 24th February, 1951. She had given birth to a living child at the 36th week, at 2 a.m. on 5th January, 1951, i.e., 50 days before admission. The labour was uneventful, lasted 3 hours and took place at her home in a village in the Howrah district, when she was attended by the village midwife. The puerperium was uncomplicated. As swelling in the abdomen persisted even after a month, she was brought down to the town residence, where she stayed with the newly born baby. She had been to a maternity hospital in Calcutta and was diagnosed as an abdominal tumour. Her family physician had her X-rayed, and, finding foetal parts, admitted her to this hospital.

The patient had been married 11 years. She was 3-para, and had no living children. The first child, a male, was born prematurely at 7 months, and died soon after birth 7 years ago; the second, also a male and premature, was stillborn, and presented by breech, 6 years ago; and the third, a male, at term, was normally born 4½ years ago, but died by drowning 2 years ago. In the present pregnancy, the date of the last menstrual period was 27th April, 1950, and the expected date of labour was 3rd February, 1951. All through the pregnancy she had suffered from abdominal pain, sometimes acute, which laid her up from 3 to 15 days; but the pain was never so acute as to make her faint. She was a chronic sufferer from malaria.

On examination after admission on 24th February, 1951, the patient was of thin build and slightly anaemic. Her temperature was 98°F., pulse 82, respiration 22 per minute, and the blood-pressure was 90/60 mm. of mercury. Her height was 4 feet 10½ inches; weight 84 pounds. Nothing abnormal was detected in the heart and lungs; the liver and spleen were palpable. There was oedema of legs and feet.

The abdomen was uniformly enlarged to 2 inches below the xiphoid cartilage. The supposed enlarged uterus was pyriform in shape and was slightly deviated to the right side. The ballotable head was felt in the right side of the upper abdomen; foetal parts were rather easily palpable. Foetal heart sounds were heard in the left side above the umbilicus, and the rate was 140 per minute. No uterine contractions were felt. No vaginal examination was made after admission. The case was provisionally diagnosed as twins a probable case of superfoetation.

The blood picture showed anaemia, with haemoglobin 58 per cent, red blood cells 3.9 millions per c.mm. Urine showed a trace of albumin. Treatment with ferri et ammonium citrate by mouth and liver extract parenterally was started. It was decided to wait till labour pains commenced.

The patient complained of slight labour pain on 5th March, 1951. Painful contractions were noticed at long intervals and this continued up to 7th March, 1951. She was examined at 11 a.m. on 7th March, 1951. Abdominally, the foetal parts seemed to be very easily palpable, but we could feel some sort of contractions in the sac, and considering the asthenic condition of the patient we were inclined to think it to be a thin-walled uterus. Foetal heart sounds were present.

A vaginal examination was made. The cervix was thick, tubular and not taken up, and admitted 2 fingers easily. The presenting part of the foetus, which could be felt through the vaginal vault behind the cervix, could not be reached with the fingers inside the cervix. On introducing the finger farther inside the uterine cavity I could feel the fundus of the uterus; the whole length of the uterus was found to be 4½ inches. The

* Read at the clinical meeting of the Bengal Obstetric and Gynaecological Society, held at the Howrah General Hospital on 27th September, 1951.

FIG. 1

Photograph of patient 15 days after operation—with both babies.
Extra-uterine baby on right of mother.

G.N

case was now diagnosed as abdominal pregnancy with a living foetus, and it was decided to deliver the baby by abdominal section. This diagnosis was further confirmed by a skiagram taken after packing the uterus with iodoform gauze.

Operation was done at 7 p.m. on 7th March, 1951. Before anaesthesia was started, the pulse rate was 102 per minute, and respiration 24. The blood-pressure was found to be 84/56 mm. of mercury. Under general anaesthesia with ether and oxygen the abdomen was opened by a right paramedian incision, 6 inches long. The anterior wall of the foetal sac was found to be loosely adherent to the parietal peritoneum. It was easily separated digitally. After packing all round with abdominal towels, the sac was opened and the baby removed after cutting the umbilical cord between two clamps. The sac was found to contain a small quantity of meconium-stained liquor amnii which was cleaned off. The placenta was found at the posterior wall of the sac and more towards the left side. The maternal attachment of the placenta was not further explored, but was found to be apparently in the region of the spleen and left kidney and the greater omentum. The umbilical cord was clamped an inch beyond the placental attachment and the redundant portion was removed. The clamp was replaced by a transfixion ligature of No. 3 chromic catgut. On exploration, the lower portion of the sac was found to be lying in front and to the left of the uterus which, with its adnexa, was completely shut off by adhesions. No attempt was made to disturb them. The empty sac was closed with continuous locked sutures of No. 3 chromic catgut, extra care being taken owing to the friability of the walls of the sac. The abdominal wall was closed as usual layer by layer, peritoneum and fascia with continuous catgut, and skin with interrupted silkworm gut sutures. The operation was finished in 35 minutes. One pint of 5 per cent glucose in normal saline was given intravenously by drip method during the operation.

The baby was slightly asphyxiated and was easily revived. The baby was a male, weighed 5½ pounds, and was found to be mature. It cried lustily after an hour. No developmental defect was detected. A skiagram taken after 4 days showed no abnormality in the bones.

Convalescence was more or less uneventful excepting an occasional rise of temperature up to the 13th day, which was accounted for as malaria and responded to quinine. Penicillin and streptomycin were given for 7 days after the operation. Skin union was good after removal of sutures on the 7th day. There was a diffuse mass in the abdomen in the umbilical region. There was no tenderness in the abdomen. No distension by gas was noticed at any time after the operation, although the patient was constipated and had to be relieved by enema every 3 or 4 days. She was allowed to sit up and walk about after the 10th day. The baby was breast fed from the 4th day onwards and there was no difficulty with the 3-hourly feeds.

On 27th March, 1951, i.e., 20 days after the operation, the patient complained of acute cramp-like pain in the abdomen. The abdominal mass, which was gradually diminishing in size and becoming circumscribed near about the front of the abdomen, was found to be tense and cystic, but not tender. There was no abdominal distension and no rise of temperature or pulse rate. Blood count showed haemoglobin 55 per cent, red blood cells 3.2 millions per c.mm., white blood cells 5,800 per c.mm., with polymorphs 72 per cent. Suppuration was suspected; but the whole mass gradually became smaller and the pain subsided after 4 days. She was kept in the hospital under observation for another fortnight. Examination before discharge from hospital showed that the patient had no complaint except general weakness. She was walking about, feeding and looking after the baby. She weighed 76 pounds. The temperature was normal for the preceding 3 weeks, the pulse was 84 per minute. The haemoglobin was 60 per cent, red blood cells 3.5 millions per c.mm. The baby was healthy, breast fed, and weighed 5 pounds 14 ounces before discharge from the hospital.

Follow-up

The patient came to the hospital on 19th September, 1951, i.e., 6 months after operation. Examination showed: general health considerably improved. Her weight was 80 pounds. There was no anaemia. The abdominal mass had diminished to a quarter of its size before discharge from the hospital, was elastic in consistency, not tender, and freely mobile, occupying the left lumbar region. On vaginal examination the cervix was found to be small and flush with the vaginal vault. The uterus was small, anteverted, mobile. Appendages were not palpable. A sample of urine was sent for male toad test for chorionic gonadotrophin. It gave a weak positive reaction.

The intra-uterine baby had died at the patient's home, from broncho-pneumonia, 3 months after birth. The extra-uterine baby was breast fed and found to be quite healthy and plump, and weighed 15 pounds.

Review of Literature

Simultaneous existence of ectopic and intra-uterine pregnancy is an uncommon condition of more than usual interest. The condition is sufficiently engaging to have arrested the attention of a few authors and to have been the subject of some excellent reviews.

Two clinical types have been differentiated. Combined intra-uterine and extra-uterine pregnancy connotes the impregnation of the tube and uterus ova within a short time of each other, whereas compound extra-uterine and intra-

uterine pregnancy refers to the superimposing of an intra-uterine pregnancy on a previously existing extra-uterine pregnancy, usually a lithopedian.

Duverney (1708) is generally credited with the first description of the combined type, discovered at postmortem examination. Since this observation, a number of cases have been reported.

Bernstein (1940), excluding the obvious compound type, collected 294 authentic cases. Ludwig (1940) reported a total of 352 up to 1938, but did not differentiate between combined and compound types.

Mitra (1940), in an excellent critical review, stated that there had not been more than 304 of the combined type reported in the world literature.

Studdiford and Speck (1944) added 18 more cases from the literature and arrived at a total of 322 (they apparently did not include Mitra's 2 cases).

DeVoe and Pratt (1948) reviewed the literature since 1938 and, excluding overlapping, added 4 new cases of Mitra, 8 of Sloat and Peterson (1938), and 31 of their own to Ludwig's 353, bringing the total to 393 up to December 1948. They have obviously included cases of compound intra-uterine and extra-uterine pregnancy.

Michaelis (1949) reviewed 13 cases from the literature and added 4 of his own, bringing the total number of cases of combined intra-uterine and extra-uterine pregnancy to 341 up to October 1947.

The patients who have been carried to term are not numerous. Gemmell and Murray (1933) collected 81 cases which terminated in living intra-uterine foetuses. Far less is the number of cases where both the foetuses went to term and terminated in live birth. From the interesting clinical study of Gemmell and Murray it appears that out of 41 cases discovered after labour, a live child was removed from the abdomen only on 5 occasions at intervals of from 1 to 23 days after labour. Only 1 case could be found to have both live babies, in the group where the condition was discovered during labour.

Besides these 6 cases of Gemmell and Murray where both babies were delivered alive at term, I could collect from the literature from 1933 up to date only 5 similar cases with both babies alive. Including my case, the total comes up to 12. From the medical literature available here I am able to present the details of 7 such cases as follows:

Case 1 (Bogdanovics, 1914). Three-gravida; 2-para; aged 28. Intra-uterine baby born at 33 weeks; 45 cm. long; 2,030 g. weight. Extra-uterine living baby removed by laparotomy—same sex; length 45 cm.; weight 2,040 g., died after 2 minutes.

Case 2 (Dubose, 1915). Age 35; 7-para. The child was born at noon on 10th January, 1913. The midwife recognized the presence of twins and made futile efforts at delivery. The physician diagnosed viable abdominal pregnancy. In the evening an abdominal section was made. The foetus was taken from the large right amniotic sac. The child weighed 2 ounces more than its sister which had been born at noon. Both children were well after 22 months.

Case 3 (De Arauju, 1925). Primipara, aged 29; suffered blood losses up to the 3rd month, pains in the lower part of the abdomen. Admitted to hospital in labour, and had passed water and blood. Cervix was not dilated. Laparotomy was done on the 3rd day. Behind the full-time pregnant uterus another mass was found adherent to the neighbouring structures. At first sight the mass looked like a fibroid. The uterus was drawn out and a live moribund foetus was delivered. While the operator was again trying to destroy the adhesions, a new foetus appeared. This was located in the right tube and was delivered alive and in good condition. The operation was completed by supravaginal amputation of the uterus and resection of the right tube and ovary. The patient died on the 15th day. The extra-uterine foetus was still alive and doing well.

Case 4 (Bondurant, 1937). Pregnancy 8½ months. The intra-uterine baby weighed 3½ pounds; lived 5 days. The extra-uterine baby weighed 2,154 g. The mother and child lived.

Case 5 (Leech, 1941). Full-time intra-uterine baby weighed 5½ pounds and was alive. The extra-uterine baby, delivered 22 days after by abdominal section, died after birth. The mother lived.

Case 6 (Rabago, 1944). Seven-gravida; age 32. Duration of pregnancy 7 months. Laparotomy with removal of living extra-uterine foetus and Caesarean section for living intra-uterine foetus. Both babies lived 2 weeks. The mother recovered.

Case 7 (Fejer and Henry, 1949). A case of full-time combined intra-uterine and extra-uterine pregnancy in an African woman; 6-para; aged 32. She was admitted 24 days after the natural birth of her child at home. An abdominal pregnancy was diagnosed by feeling the foetal parts per abdomen and an empty uterine cavity by vaginal examination. The foetal head could be palpated behind the vagina. A living

female child was delivered by abdominal section. The placenta, which was attached to the back of the uterus and floor of the pelvis, and received a supplementary blood supply from omentum, was removed. Owing to considerable haemorrhage hysterectomy had to be done. The extra-uterine baby was completely normal. Both babies died later within 3 months.

Clinical Features

Cases of combined intra-uterine and extra-uterine pregnancy at or near term can be clinically classified into two groups.

(1) *Cases discovered after labour.* This group constitutes the majority. Gemmell and Murray report 41 such cases with 6 deaths (14.6 per cent). In exactly half the cases in which notes are given of the patient's symptoms during pregnancy there were none, or only an unusual increase in the size of the abdomen. In 6 cases the intra-uterine pregnancy ended in abortion. In 2 cases forceps were used at term, and all the remaining patients had normal deliveries, although one was sent to hospital as a case of labour obstructed by tumour.

After delivery, in half the patients a symptomless mass in the abdomen was noted, sometimes with palpable foetal movements and sometimes without. The other half had varying symptoms usually suggestive of infection or intestinal irritation. In 12 cases the symptoms were so insignificant that treatment was not attempted for the retained mass. Eight of the patients passed the foetus piecemeal through fistulae. Five live babies were delivered by abdominal section at intervals of 1 to 23 days after labour.

The foregoing may be summarized as follows. Half these patients have no symptoms before or after delivery. The ectopic foetus gives little or no trouble during delivery and may be removed with comparative safety after delivery. In some cases, it is possible to save the life of the ectopic foetus.

(2) *Cases discovered during late pregnancy or during labour.* Only 2 cases have been found to belong to this group. In both of them diagnosis was made during operation. Late in pregnancy an abdominal foetus can be diagnosed by its high position in the abdomen. Foetal parts can be felt with unusual ease. Absence of Braxton Hicks contractions is a most important diagnostic sign, but in our case we felt some sort of contractions or tightening of the sac. The surest sign, however, can only be found by vaginal examination.

Abdominal pregnancy can often be ruled out in a simple manner by introducing the fingertip into the cervix and palpating the presenting part of an intra-uterine foetus. In the case of extra-uterine foetus the fingertip will reach the fundus, thus demonstrating an empty uterus. A skiagram with a sound or lipiodol or iodoform gauze pack inside the uterus will establish the diagnosis for certain.

Summary

A case of combined full-time intra-uterine and extra-uterine pregnancy has been described. The intra-uterine baby was born naturally at the 36th week. The extra-uterine baby was delivered alive by abdominal section 61 days after the birth of the intra-uterine baby and 312 days after the last menstrual period. During operation no attempt was made to explore or remove the placenta which was left inside the abdomen to be absorbed. The mother had no complications and after 6 months the placental mass was three-quarters absorbed. The intra-uterine baby died after 3 months. The extra-uterine baby was perfectly normal and was seen to be well after 6 months.

The literature has been reviewed for the total number of reported cases of combined intra-uterine and extra-uterine pregnancy. Among these, 12 cases of full-time combined pregnancy have been found (including the case reported here). Detailed reports of 7 such cases have been presented.

The incidence of combined pregnancy has been discussed and calculated to be 1 in 33,000.

The clinical features of the two groups of full-time combined pregnancy have been described and diagnostic methods detailed. Most of the cases have been discovered after labour and a few during late pregnancy or during labour. Absence of Braxton Hicks contractions, finding of an empty uterus by vaginal examination, and skiagraphy are important diagnostic points.

The fate of the extra-uterine foetus is precarious, as found from the figures presented by different workers. The foetal mortality varies

from 75 to 85 per cent. Of the babies who had been born alive, only 50 per cent have been found to survive 8 days or more.

I wish to acknowledge my thanks to Dr. M. K. Talukdar, B.Sc., M.B., Civil Surgeon and Surgeon Superintendent, Howrah General Hospital, for his kind help and permission to publish this case, and the resident medical staff of the hospital, specially Dr. Miss S. Biswas, and Dr. Miss N. Sen, from whose care and interest this case had a successful termination.

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CONGENITAL TUBERCULOSIS

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ALTHOUGH rare, congenital tuberculous infection is a definite entity, unequivocal proof of its occurrence being available in the literature (Warthin and Cowie, 1904; Péhu and Chalier, 1908; Whitman and Greene, 1922; Beitzke, 1935; Hughesdon, 1946). While its existence is recognized, the exact method of its transmission is still in doubt. According to the consensus of modern opinion, germinal transmission plays no part; transference of tubercle bacilli to the foetus by way of the placenta is regarded as the most probable method of development. The frequency with which it occurs cannot be estimated with any degree of accuracy, since the placenta is usually disposed of without histological or bacteriological examination being undertaken. Even if such examination is made, an existing tuberculous focus may remain undetected, Schmorl and Geipel (1904) affirming that in certain circumstances as many as 2,000 serial sections of the placenta may have to be examined microscopically to demonstrate the presence of disease. Accordingly, failure to find a focus does not constitute proof of its non-existence. Warthin and Cowie (1904), Löwenstein (1945), and others, believe that placental tuberculosis occurs more frequently than is generally assumed, an opinion which may be accepted only because it is difficult to disprove.

The following criteria insisted on by Beitzke (1935) as evidence of the existence of congenital tuberculosis are as inflexible as they are infallible. (1) The tuberculous character of the lesion in the infant must be established; (2) a primary complex in the foetal liver is proof of the congenital nature of the tuberculous changes, since it can arise only from tubercle bacilli in the blood of the umbilical vein; (3) if there is no primary complex in the liver, the infection is congenital only if (*a*) tuberculous changes are found in the foetus *in utero* or at birth, or a few days after birth, and (*b*) in the case of a child who lives longer than a few days, extra-uterine infection can be excluded with certainty, the child being separated from the mother immediately, and removed to an environment free from the possibility of any tuberculous infection. It is very probable that, restricted by these rigid criteria, many instances of congenital tuberculosis may be missed or, if recorded, must be classified "unproven", diagnosis having been based on circumstantial evidence alone.

Fundamentally, presupposing a tuberculous bacillaemia in the mother, placental disease precedes foetal infection, and the subsequent manner of spread from the placenta determines the site of the primary complex. Thus, bacilli transmitted through the medium of the cord blood become localized in the liver. Löwenstein (1945) believed that such transmission is most likely to coincide with separation of the placenta, for, as the placenta is torn from the uterine wall, there is resulting destruction of the villi, and consequent free mingling of foetal and maternal blood. Alternatively, when the lesion in the placenta is ulcerative, the lungs or digestive tract become involved following inhalation or ingestion of amniotic fluid. Whitehead *et al.*

(1942) contested the theory of infection by inhalation, demonstrating that "Thorotrast" (thorium dioxide), when injected into the liquor amnii, failed to reach the pulmonary alveoli. The present writers, however, submit the opinion that in the causation of lung disease it is unnecessary for tubercle bacilli to pass directly to the alveoli, phagocytes being capable of transporting the organisms through the bronchial mucosa to the underlying lymph spaces (Boyd, 1944), from which spread to the alveoli may occur with the onset of respiration.

The final result of transplacental infection is still problematical. When this occurs early, abortion or intra-uterine death may ensue. The prognosis for children who are born alive would seem to be unfavourable generally and, according to Hughesdon (1946), death results at the 37th day approximately in the majority of cases. Survivors have been reported, however, Schaefer (1939) recording the case of one child alive and well 2½ years after birth, and Löwenstein (1945) makes reference to 3 children who were in quite normal health at the end of from 3 to 6 years. The latter worker suggests the following explanation to account for such survivals. If it is conceded that infection is intrapartum in occurrence, ligation of the cord will prevent further influx of the bacilli, and thereby limit its severity. In certain instances the child's resistance is sufficiently high to deal effectively with such an infection and, in this event, the ultimate fate of the organisms becomes a matter of speculative interest. They may be destroyed, or may remain latent for many years, and it is of interest to note that Chiari (1932) recorded one example of a healed tuberculous focus in the liver, and similar isolated instances have been reported by Beitzke (1935), Thorn (1894), and Harbitz and Mørdre (1931). Zarfl (1930) demonstrated a healing lesion in the same organ.

The following case report is recorded because of its exceptional interest, its relative rarity, and the fact that it may contribute towards the final elucidation of congenital tuberculosis.

Case Report

Mrs. Jane P., age 26, was admitted to a general hospital in the City of Glasgow on 13th May, 1951, when it was found that she was 14 weeks advanced in pregnancy, and was suffering from miliary tuberculosis complicated by a right pleural effusion. Treatment by dihydrostreptomycin, 0.5 g. twice daily by intramuscular injection, and para-aminosalicylic acid, 3 g. orally, 4 times per day, was instituted and maintained without development of toxic effects. On 13th July she was transferred to a sanatorium, where dihydrostreptomycin therapy was continued until 5th August, when she was discharged home at her own request and against medical advice.

On the day prior to leaving the sanatorium, she complained of severe frontal headache, but there were no clinical manifestations of actual meningitis at this time.

On 18th August, 1951, she was admitted to Robroyston Hospital, Glasgow, an institution which provides special facilities for the care and treatment of pregnant tuberculous patients. On admission she was comatose, profoundly toxaemic, cyanosed, and her temperature was 103°F. (39.5°C.). Tuberculous meningitis was suspected, and this was confirmed biochemically on 18th August, and later biologically, on 3rd October. Radiological examination of the chest showed miliary opacities in the lung fields. On abdominal examination, the uterus was found to be enlarged to the size of a pregnancy of 28 weeks duration.

The vertex was presenting. The foetal heart rate was heard to be regular, 136 beats per minute, but the sounds were of poor quality. Treatment with dihydrostreptomycin was instituted, a dose of 100 mg. being given by the intrathecal route, and 1 g. by the intramuscular route daily. The patient's condition deteriorated further, cyanosis increased, and death occurred 2 days later. The foetal heart was listened to at frequent intervals, and the sounds, though soft, continued to be regular in rate and rhythm. Shortly before death, strong uterine contractions were detected, these increasing in frequency despite the patient's obviously failing circulation, and within 10 minutes of their onset she was delivered spontaneously of a premature child which failed to breathe, but in whom a heart beat was noted. Although active resuscitative measures were instituted, respiration did not become established, and gradually the foetal heart became slower until it finally ceased. The placenta was delivered spontaneously 2 minutes after the birth of the child, and thereupon the mother's death occurred. Autopsies were performed on the bodies of both mother and child, and the following information was obtained.

Pathological Reports

Mother. A miliary tuberculosis was found. The viscera affected were the lungs, kidneys, and spleen. The brain was oedematous, and the meninges showed the changes typical of tuberculous meningitis. The reproductive organs, and especially the placental site of the uterus, were examined, with particular care, and were found to be free from disease.

Histological examination of the viscera confirmed the presence of miliary tuberculosis.

Foetus. This was a male, weighing 1 pound 7 ounces (655.5 g.), and measuring 16 inches (40.6 cm.) in length.

The nutritional state was average for one of a comparable maturity, and external appearances were those of an apparently normal but premature foetus. The skin was pale and wrinkled, and there was an absence of subcutaneous fat. Examination of liver, spleen, kidneys, and suprarenal glands failed to show any abnormalities. The lungs appeared to be atelectatic. There was no evidence of tuberculosis on microscopical axamination of serial sections of the abdominal viscera. Sections of the lungs were found to be free from tuberculosis, and showed evidence of partial aeration of the alveoli, so that atelectasis was not so complete as the macroscopic appearances and flotation tests suggested. The cause of death was presumed to be prematurity and partial atelectasis.

The Placenta, which weighed 18 ounces (228 g.), was discoid in shape and measured 5½ inches (14 cm.) in diameter. At the funic attachment, which was central, it measured ¾ inch (1.9 cm.) in thickness and the marginal thickness was ¼ inch (0.6 cm.). To the naked eye it was normal in shape, colour, and cotyledon formation, but on close inspection several macroscopic tubercles were seen scattered over the maternal surface. On histological examination, numerous tubercles were found to exist throughout its substance (see Fig. 1).

Discussion

This case report presents certain features which are significant and merit special note. The establishment of tuberculous disease in the placenta is indicative of a tuberculous bacillaemia in the mother, and the clinical manifestations of acute miliary tuberculosis complicated by meningitis substantiate such a claim. Attention is drawn to absence of pelvic tuberculosis, especially of the uterus and, in particular, of the placental site. Despite a preceding active and extensive tuberculous infection of the mother, the foetus although stillborn was singularly free from tuberculous disease. Reference to the literature provides several similar instances (Fossel, 1936; Exchaquet *et al.*, 1938), and it is of interest to note that Gunn, Nagley, and Beven (1951), who quote 7 cases of miliary and/or meningeal tuberculosis, and include 1 of their own, found in this series only 1 foetus in which tuberculous disease could be demonstrated. Accordingly, it is difficult to evade the conclusion that the placenta can provide an effective barrier even in the presence of overwhelming disease in the mother. That this is not always the case, however, is shown by the fact that ulcerative tuberculous lesions can develop in the placenta.

Having encountered cases similar to those of the above-quoted authors, Warthin and Cowie (1904) concluded that tubercle bacilli could reach the foetal circulation without producing any demonstrable lesion in the placenta through which they had passed. Further, in their opinion, tubercle bacilli may be present in the foetal circulation without giving rise to a foetal lesion. According to these workers, "a latent tuberculosis is possible and probable, but additional investigations are necessary to settle the question of the frequency of such an event". Whitman and Greene (1922) subscribe to this belief.

This failure to find evidence of focal tissue reaction in the foetus is, after due consideration, not so unexpected, since specific structural changes are not usually demonstrable until 6 to 8 weeks after a primary infection occurs. The writers know of no good reason why there should be a departure from this general rule in the case of the foetus. Indeed, this theory could be applied in the case which is under discussion. It might be argued that if the foetus were actually infected this occurred late in pregnancy or during parturition, and that the foetus died from atelectasis and prematurity before a focal tissue reaction to the tuberculous infection had time to develop. Conversely, foetal deaths from tuberculosis at birth, or early in the neonatal period, are probably the result of infection acquired earlier in pregnancy, 6 to 8 weeks at least before delivery. It is regrettable that in the case under review the precise cause of foetal death was not easily ascertainable, but prematurity was presumed responsible.

Contributory factors to foetal death may have been pyrexia (103°F.), profound toxaemia, and anoxaemia; and the possible effects on the foetus of dihydrostreptomycin must be taken into account. While it is unlikely that the very small amount of streptomycin given by the intrathecal route (total=300 mg.) could have had an injurious effect, it must be admitted that its prolonged intramuscular administration (total=82 g.), in the form of dihydrostreptomycin, may not have been so innocuous. Evidence relating to the toxic effects of dihydrostreptomycin is

accumulating (Cathie and Garrow, 1951), and an authoritative assessment of its dangers is desirable.

Considering this case in retrospect, it is suggested that certain practical measures might be applied to prevent further catastrophes in the same category. Conceding that congenital tuberculosis can occur, it is evident that every tuberculous mother, especially if she has an active pulmonary lesion, constitutes a potential danger to her offspring. Ideally, routine chest films should be taken at antenatal clinics and, where necessary, pregnant tuberculous patients admitted to hospital early for appropriate treatment of the combined conditions. For obvious reasons medical supervision should be the joint responsibility of the chest physician and obstetrician respectively. It may be remarked that treatment for the chest condition is of vital importance, taking precedence over the pregnancy, and that, in general, the obstetrical management is along orthodox lines. It must be pointed out, however, that, if it is accepted that the foetus is more liable to infection during parturition, it follows that routine practices of milking the umbilical cord, and delaying its ligation until pulsation has ceased, though beneficial in the healthy, must be condemned in the tuberculous patient, especially if her lung lesions are miliary in type. In some cases elective Caesarean section after the 28th week might be worthy of consideration, but in the present instance the general condition of the mother was such that she would not have survived any operative intervention.

Summary

A case of acute miliary tuberculosis with meningitis complicating a pregnancy of 28 weeks duration is described. The mother died immediately after delivery. It is noteworthy that the stillborn foetus presented no evidence of tuberculosis, whereas the placenta showed macroscopic and microscopic signs of this disease. Reference is made to relevant literature. Probable modes of development of tuberculous disease of the newborn are discussed, and possible methods for its prevention are suggested.

Acknowledgment is made to Dr. M. A. Foulis, Medical Superintendent, Robroyston Hospital, Glasgow, for permission to publish details of this case, and to Dr. John Hewitt, Royal Maternity Hospital, Glasgow, for his helpful criticism and advice. The authors wish to thank Dr. W. McNaught, Stobhill Hospital, Glasgow, for sections and pathological reports, and Mr. Pearston, Royal Samaritan Hospital, Glasgow, for the photomicrograph.

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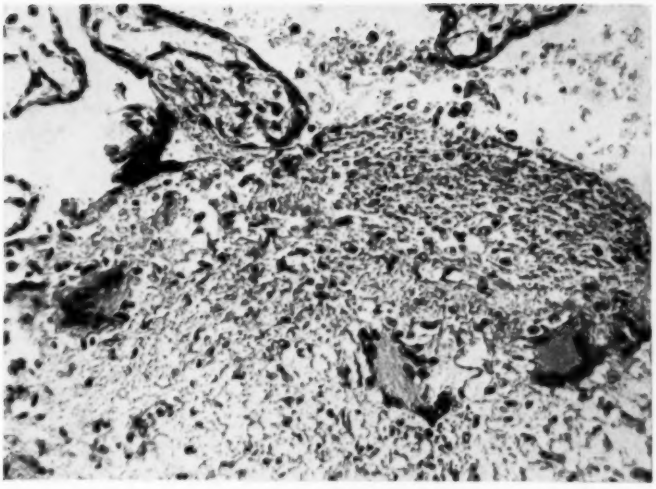

FIG. 1

Cross-section of the placenta, showing a tuberculous focus consisting of an area of necrosis, surrounded by loose connective tissue in which there is round-cell reaction, and several tuberculous giant cells.

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ADRENOCORTICOTROPHIC ACTIVITY OF PLACENTAL EXTRACTS

BY

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AMONG the factors that tend to restrict the use of corticotrophin are the limited supply of the hormone and occasional allergic reactions to foreign protein. For these reasons it seemed worth while to look for a source of adrenocorticotrophic activity in tissues of human origin.

The fact that during pregnancy rheumatoid arthritis and certain so-called collagen diseases disappear, pointed to the possibility that the placenta might produce ACTH along with gonadotrophic and other hormones. This would also explain why excretion of 17-ketosteroids is significantly increased in pregnancy. It has also been reported that the use of postpartum plasma (Granirer, 1951) and placental extracts (Dillon and Majnarich, 1951) gives beneficial results in rheumatoid arthritis. In fact, Jailer and Knowlton (1950), employing the adrenal ascorbic acid depletion test in newborn and hypophysectomized rats, found that acetone-dried placental tissues from a patient with Addison's disease showed appreciable corticotrophic activity, which was still present after the extracts were boiled, a procedure known to destroy gonadotrophic and posterior pituitary hormones. Tarantino (1951) prepared extracts from both human and bovine placentas that decreased both the adrenal ascorbic acid and circulating eosinophils in hypophysectomized rats. The active principle resembled pituitary corticotrophin in being thermostable, dialyzable and sensitive to formaldehyde. Studies with bovine placenta showed the adrenocorticotrophic activity to be present in the chorion and not in the decidua. Tarantino therefore assumed that the placenta not only stores but itself elaborates the active substance. Opsahl and Long (1951) reported similar observations. When fresh placental tissue was extracted, fractions with corticotrophin activity comparable to that of standardized commercial anterior pituitary corticotrophic preparations could be obtained. Frozen and stored placental tissues yielded considerably less potent extracts. Recently Cohen and Kleinberg (1952) found that human placenta contains 4–5 I.U. ACTH per kg. fresh weight, as assayed by the Sayers test.

On the other hand, Böe and Salvesen (1952) failed to demonstrate adrenocorticotrophic activity in placental extracts. The reason for the latter results is obvious, since human placenta as well as human blood and urine contains an enzyme which rather quickly destroys ACTH on standing. This enzyme is inactivated by addition of an equal part of acetone to the fluid or tissue to be examined, a procedure which also precipitates inert proteins, leaving ACTH in the supernatant. This procedure must be carried out immediately after removal of a biological fluid or tissue from the human body, a fact that was apparently unknown to Böe and Salvesen.

Until now the existence of at least two ACTH factors has been assumed (Reinhardt and Li, 1951; Young, 1951; Stack-Dunne and Young, 1951). According to this, ACTH could be determined in hypophysectomized rats with two different methods, the adrenal ascorbic acid depletion method and the basic adrenal weight increase method. Recent work of one of us (Sulman, 1952c) which had been independently

confirmed by Johnsson and Högberg (1952) has shown that there exists a third factor in the ACTH group which seems to be identical with the hormone known until now as "intermedin" (Zondek and Krohn, 1932; Zondek, 1935a, b). Hence it was proposed to differentiate between three ACTH factors:

A = Adrenal ascorbic acid depleting factor.

B = Basic adrenal weight increase factor.

C = Chromatophorotrophic factor.

Study of the occurrence of the C-factor in some 400 human patients has shown us that the C-factor occurs in relatively high amounts in human blood in all cases where high production of the A- and B-factor has been reported. Since in man all three ACTH factors apparently occur simultaneously, we used the determination of the C-factor in human placenta as a measure for its total ACTH content.*

Method

Two methods of preparation were tried, that of Zondek for intermedin (1935 a, b), and that of Sulman (1952 a, b, c) for the C-factor of ACTH. Since the latter method extracted much more hormone than the former, we adapted it for the extraction of placenta as follows. Preparation of the placental extracts was carried out in a room adjacent to the delivery room in order to avoid any delay and loss of ACTH by the aforementioned enzyme. During the 3rd stage of delivery 200 ml. of retroplacental blood were collected from the patient for comparison of the C-factor in the blood with that of the placenta. This procedure was necessary in order that no time be lost in freeing the placenta from its natural blood contents. Immediately after delivery the placenta was externally washed with tapwater, minced in a meat grinder, weighed and stirred into a volume of acetone equal to the weight of the sample. The precipitate was removed by suction through a Büchner funnel and discarded after one series of examinations had proved it devoid of significant amounts of the C-factor. The filtrate was poured into 9 times its volume of acetone and allowed to stand for 12 hours in the refrigerator. Then the supernatant acetone was decanted and the precipitate dried by washing with ether. Finally it was dissolved in n/20 NaOH (1 ml. corresponding to 10 g. of placental tissue), shaken for one hour, neutralized with some drops of n/4 acetic acid, centrifuged, and the supernatant injected into green-adapted tree frogs (*Hyla arborea*). Simultaneously the retroplacental blood of the same patient was assayed by the same method for its contents of the C-factor.

Results

The results in Table I show that the ACTH C-factor is about 3 to 12 times more abundant in the placenta than in retroplacental blood taken from the same patient. This fact suggests that the placenta produces ACTH.

Table I

ACTH C-factor in human placenta and retroplacental blood

Patient	ACTH in blood frog units† per litre	ACTH in placenta frog units† per kg.
1	25	200
2	50	250
3	100	300
4	25	300

† 1 frog unit corresponds to 1 gamma of the international ACTH standard.

As a control we studied the ACTH content of some organs and the blood of a bitch. The bitch was electrocuted by the method of Sulman (1949). The organs were immediately removed, washed, weighed, extracted, and examined as above. The results in Table II indicate that small amounts of the ACTH C-factor could be found in the blood and muscles. The blood value of the bitch was similar to normal human blood.

* It appears that all three factors occur simultaneously in those species which have practically no intermediate lobe (primates, fowl and cetaceae) and thus produce the C-factor in the basophilic cells of the anterior lobe. When, however, a separate intermediate lobe exists, it may be possible that production of the melanophore hormone is independent of other ACTH factors. This problem is now under investigation.

TABLE II

ACTH C-factor in the organs and blood of a bitch.

Organ	ACTH per kg. tissue (or per litre of blood)
Muscle	50 frog units
Uterus	less than 40 frog units.‡
Kidneys	less than 40 frog units.‡
Spleen	less than 40 frog units.‡
Blood	50 frog units

‡ These organs gave negative results at a dosage at the limit of toxicity.

CONCLUSION

ACTH is formed in the human placenta. The amounts found with our method are, however, not sufficiently high to warrant its use for the manufacture of ACTH for general use. It may, perhaps, be worth while to reserve this procedure for those rare cases in which sensitivity towards ACTH of animal origin has been encountered.

The fact that the placenta produces the ACTH C-factor along with other hormones of the pituitary anterior lobe (e.g. ACTH A-factor, FSH, LH, LTH) shows that the placenta may replace the anterior lobe in the pregnant body. Furthermore, it indicates that the so-called intermediate lobe is functionally part of the anterior lobe.

We are indebted to Mr. E. Zawojski for his devoted help.

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PRIMARY CARCINOMA OF THE VAGINAL VAULT FOLLOWING TOTAL HYSTERECTOMY FOR NON-MALIGNANT CONDITIONS

BY

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PRIMARY carcinoma of the vagina is a comparatively rare condition, but 3 patients who had developed this some years after total hysterectomy for non-malignant conditions have come under our observation recently. In none of these cases was the cervix suspected at the time of operation, but in no case was an extensive search made of the cervix for coincident carcinoma or a pre-cancerous lesion. The problem, therefore, arises—is this condition due to an incomplete removal of the cervix and its vaginal attachments or is it just chance that a true carcinoma of the vagina occurred in a woman who had had a total hysterectomy?

In the available records at Bristol we can only find 11 cases of primary carcinoma of the vagina in the past 15 years, during which time the number of total hysterectomies performed in the Department was approximately 1,500. Four of these are cases where the primary carcinoma of the vagina occurred on an old-standing procidentia. One case involved the cervix and, therefore, though clinically it was a primary vaginal lesion, some doubt must be cast on the origin of the tumour. In another case the lesion was an adenocarcinoma and is likely to have originated from Bartholin's gland or Gaertner's duct. This, therefore, only leaves 5 true primary carcinomata of the vagina, and 3 of these followed total hysterectomy and were at the vaginal vault, while the other 2 were low down in the vagina.

The following are the 3 case records:

CASE 1. F.M., aged 49, was admitted in 1943 complaining of menorrhagia of 3 months duration. She had had 1 child and 1 miscarriage. On examination a mass of uterine fibroids was diagnosed. The cervix was inspected and, apart from a small laceration, appeared normal. A total hysterectomy and right and partial left oöphorectomy was performed. There were several large uterine fibroids and there were adhesions of the ovaries and tubes to the posterior wall of the uterus and to the pelvic peritoneum and to the small intestine. Because of these adhesions the cervix was removed by dissecting the parametrium off the cervix and leaving a cuff of parametrial tissue. Microscopically the ovary showed a heavy infiltration with chronic inflammatory cells. The uterine endometrium and cervix appeared normal but were not sectioned.

She was seen again in January 1949, when she complained of some pelvic pain and a blood-stained vaginal discharge. On examination she was found to have a mass 2 inches in diameter in the vaginal vault with dense induration extending into the parametrium. A biopsy was taken and this showed a Grade I epithelioma. She was treated by radium, being given 4,950 mg.-hours, and this was followed by X-ray therapy. The pelvis remained indurated and 3 years later she developed a recto-vaginal fistula for which a colostomy had to be performed. She now has bony metastases in the sacrum and gross recurrence in the pelvis.

CASE 2. E.B.M., aged 42, was admitted in 1944 with menorrhagia. She had had 1 child. The cervix was examined and was found to be normal and the uterus contained a small fibroid. A total hysterectomy was performed. There were many adhesions of the tubes to the posterior wall of the uterus and to the small intestine so that the cervix was removed by dissecting the parametrial tissue away from it in the form of a cuff. Inspection of the specimen showed no suspicion of malignancy although no microscopic examination was made.

In 1952, the patient reported with low backache and a blood-stained vaginal discharge. On examination an extensive area of induration at the vaginal vault was found. A biopsy was taken and this revealed an unusually well differentiated epithelioma with well-formed epithelial pearls. The general condition of the patient was poor, and the blood urea was 200 mg. per cent. Intravenous pyelography showed a bilateral

hydronephrosis. After bilateral nephrostomy had been performed the blood urea fell to 40 mg. per cent. Both ureters were then transplanted into the colon and this was followed by a wide bilateral excision of the parametrium together with the iliac glands *en bloc*, a bilateral salpingo-oöphorectomy, a total vaginectomy, and a total cystectomy. We have not so far been able to dispense with the nephrostomies. The specimen showed a well-differentiated epithelioma at the vaginal vault which infiltrated the bladder wall, the parametrial glands, and had blocked both ureters.

CASE 3. G.C., aged 40, was admitted in 1937 with a history of pelvic pain, a heavy yellow discharge, and menorrhagia. She had had 4 children. On examination a large mass was found on both sides of the uterus which was semi-cystic, tender, and attached to the uterus. The cervix appeared normal. At operation a bilateral pyosalpinx was found which was densely adherent to the caecum, rectum, and the pelvic wall. The uterus was of normal size. A total hysterectomy and bilateral salpingo-oöphorectomy was performed, the parametrium being dissected out as a cuff around the cervix to avoid damage to the adherent intestine. Section of the tubes showed a bilateral non-tuberculous salpingitis and oöphoritis. The cervix was considered to be normal and was not sectioned.

Twelve years later the patient complained of pelvic pain and a blood-stained vaginal discharge. On examination there was a large area of induration in the vaginal vault. A biopsy was taken which showed a well-differentiated epithelioma. She was treated by radium, being given 6,000 r in 8 days. She has made a good recovery and now, 3 years later, is fit and well.

These cases have prompted us to write to other centres and to try to gain an impression of the experience of other workers. We are indebted to Mr. Kenneth Bowes for the following case report:

The patient, a woman of 38 years of age, had had 1 child. She complained of backache and visited a gynaecologist in the East. He found the cervix unhealthy, took a biopsy, and considered the condition pre-cancerous (in 1938). She came to England where the slides were submitted for further report to 2 expert pathologists, who said they could not advise the cervix to be removed for evidence of malignancy. On examination the uterus was found to be bulky with a palpable mass the size of a marble, situated posteriorly. The cervix had the appearance of a multiparous cervix with evidence of recent biopsy. There was no ulceration. To relieve the patient's pain and in view of the probable adenomyosis, a total hysterectomy and bilateral salpingo-oöphorectomy was performed and adenomyosis was confirmed. The cervix was sectioned for evidence of carcinoma in 4 places but no evidence of malignancy was found.

The patient reported 7¼ years later (in 1945) with vaginal haemorrhage. A mass was found in and above the vaginal vault the size of a tangerine orange. A biopsy was taken and this was found to be a squamous-celled carcinoma. She was submitted for radiotherapy and died a few months later.

The original slides were resubmitted in view of modern knowledge and the opinion then advanced was that the original lesion had been a carcinoma *in situ* of the same cellular type.

Mr. Bowes believes that this was a recurrence and not a separate carcinoma of the vaginal vault, as the age of the patient and the time interval are very suggestive. He notes that the hysterectomy was an ordinary adequate total hysterectomy but thinks that the removal of the vaginal cuff at the same time would probably have been better.

Mr. John Blaikley sends us the report of a case of his:

Mrs. D., aged 42, had a total hysterectomy in 1926, the indication being unknown to Mr. Blaikley although the patient told him that the question of a carcinoma had been raised but that this was not confirmed by microscopy. Eleven years later, in 1937, at the age of 52, she developed malignant glands of both groins which were reported as containing squamous-celled carcinoma. These were treated by radium plaques. In 1947, 21 years after the total hysterectomy, at the age of 63, she was found to have a squamous-celled carcinoma of the vaginal vault. This was treated with radium but she developed a recurrence and died in 1950.

Mrs. Willmott Dobbie has sent me details of 5 cases of primary carcinoma of the vaginal vault (out of a total of 60 cases of primary carcinoma of the vagina), who had had a total hysterectomy previously for what were believed to be non-malignant conditions. This is certainly a higher proportion than one would have expected if this was solely coincidence.

These are the only cases of this nature that have come to light in spite of the fact that we have discussed the matter with several centres. The condition must, therefore, be a rare one and is not nearly as frequent as the condition of stump carcinoma. The cases may have arisen by chance but, as we have pointed out, they represent 60 per cent of the carcinomata of the vagina and 100 per cent of the carcinomata of the vaginal vault at this centre. It seems likely therefore that some further factor is involved.

It may be that a portion of the cervix was left behind, so that the cases may be considered as stump carcinoma of the cervix. This might have happened in our own cases as each one was associated with chronic pelvic sepsis and with dense pelvic adhesions so that the cervix was stripped closely down from a parametrial cuff. This would serve to point out the fact that it is essential to remove the cervix completely and that an attempt to keep too close to the cervix in dissecting out the parametrium may result in inadequate removal.

In stump carcinoma it is usually considered that, if the carcinoma appears within 2 years of the original operation, it was present but overlooked at the time of the sub-total hysterectomy. In all our cases the carcinoma of the vaginal vault appeared much later than the accepted 2-year standard, being 6, 8, 12, 7½, and 21 years later. It may be that the presence of a primary growth in the cervix or body of the uterus of a very low grade malignancy, or even of the *in situ* type, may be associated with this late appearance of the carcinoma.

Finn (1952) has recently reported that he has found 12 Stage I and 9 Stage O carcinomata of the cervix on microscopic examination of the cervix post-operatively. This was in a series of 1,876 total hysterectomies performed for other reasons at the New York Hospital during the last 5 years. All were entirely unsuspected clinically. The fact that Stage O and Stage I carcinoma of the cervix may be present without being suspected by careful clinical examination serves to point out the fact that cervical biopsies should be taken pre-operatively.

It is well recognized that secondaries from a carcinoma of the body of the uterus occur in the vaginal vault after hysterectomy. This may be due to implantation at the time of the hysterectomy or to incomplete removal of the lymphatic spread. Indeed there may well be a case for wider excision of the vaginal vault in cases of carcinoma of the endometrium, especially in those arising near the internal os.

It is well known that the vaginal vault is involved early in carcinoma of the cervix, and American writers, amongst them Galvin and TeLinde (1949), stress the fact that in Stage O carcinoma of the cervix, the vault of the vagina must be removed as well as the uterus if a cure is to be obtained. Mr. Stanley Way, in a personal communication, tells us that he has had a case of invasive carcinoma of the cervix with an *in situ* lesion of the vaginal vault and another case of a primary carcinoma of the vaginal vault with an *in situ* lesion of the cervix. It would thus seem that the vaginal vault should be removed in cases where pre-malignant or malignant conditions exist. It is interesting to note that the appearance of a carcinoma of the vault following a repair with amputation of the cervix or a vaginal hysterectomy is rare. This may be due to the fact that a wide excision of the cervix is performed.

Conclusions

Although carcinoma of the vaginal vault is a rare complication following total hysterectomy it would seem wise to biopsy the cervix before performing the operation, and that if a pre-malignant condition is suspected then the uterus should be removed with a good cuff of vaginal tissue. Even if no malignant condition is suspected one should remove the cervix completely and not shell it out of the parametrial tissue, thereby running the danger of leaving even small portions of the vaginal cervix behind.

Summary

Three cases of carcinoma of the vaginal vault following total hysterectomy that have occurred at this centre are reported.

Similar cases that have occurred in other centres are also reported.

A plea is made for pre-operative biopsy of the cervix and for the complete removal of the cervix at the time of hysterectomy.

We are indebted to Mr. H. L. Shepherd for his help and kind permission to publish these cases, and to Professor G. Gordon Lennon for his encouragement. We also wish to thank all those from other centres who have provided either case histories or constructive criticism, both of which have been extremely valuable in compiling this paper.

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ADENOACANTHOMA IN A UTERINE FIBROID

BY

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TUMOURS composed of glandular and squamous elements may be designated as adenoacanthomata. Such tumours in the corpus uteri have been described, but are by no means common. The following is an example of such a growth.

The patient, aged 39, was referred to the gynaecological clinic on 30th January, 1948, complaining of heavy periods for the previous 8 months and more recent intermenstrual bleeding. Although she had mitral stenosis, her general condition was satisfactory. Examination under anaesthesia revealed a slightly enlarged uterus and palpable right ovary. Curettage produced strips of thick endometrium. Microscopically this was shown to be in the proliferative phase with a chronic inflammatory reaction in the stroma. One or two small portions of the tissue showed whorls of squamous cells in relation to the columnar epithelium of the glands (Fig. 1) or lying free in the stroma, and in these portions smooth muscle fibres could be identified. The significance of these findings was not appreciated and no further treatment was undertaken at this time.

Intermittently she continued to have profuse periods and was admitted to hospital for conservative treatment on two occasions.

However, by 15th November, 1950, as there had been no amelioration of her symptoms, curettage and insertion of a menopausal dose of radium were carried out. The curettings (Fig. 2) showed portions of endometrium in the proliferative phase with round cell infiltration and fibrosis in the stroma. In certain areas, irregularity of the gland acini was more marked, a few mitotic figures were present, and, as in the previous curettings, islands of squamous epithelium were seen, though these were now larger and more numerous, some even suggesting keratin formation. In the stroma of these areas, smooth muscle fibres were present, suggesting that invasion of the myometrium by epithelial elements had occurred.

In view of the possibility of a maligant uterine tumour laparotomy was undertaken. Total hysterectomy with bilateral salpingo-oöphorectomy was performed.

The uterus was slightly enlarged and surmounted at the fundus by a pedunculated subserous fibroid, while numerous smaller fibroids were present in the myometrium. The uterine cavity was smooth-walled except in its upper portion where a soft polypoidal mass protruded into the cavity (Fig. 3). The adnexae showed no gross abnormalities.

Histologically the pedunculated subserous and intramural fibroids showed a typical fibromyomatous structure. The endometrium was proliferative in type, with fibrosis of the stroma.

The soft polypoidal mass in the region of the fundus possessed the basic structure of a submucous fibromyoma. Interspersed among the fibromuscular bundles were gland acini and numerous plaques of squamous epithelium (Fig. 4). The acini had a lining of columnar epithelium, usually one to two layers thick, and resembled endometrial glands in the proliferative phase. There was no evidence of secretion and no endometrial stroma. The squamous plaques varied considerably in size and shape (Fig. 5); many were like epithelial cell nests, others showed central areas of necrosis. Several appeared to arise in direct continuity with the columnar epithelium of the gland acini into which the squamous cells projected like glomerular tufts, as has been described by Meyer (1923). In some fields groups of squamous cells were seen lying free in the gland lumina. The epithelium covering the tumour was columnar with, here and there, small areas of early squamous metaplasia. Mitotic figures were few and invasive characteristics lacking. Thorough examination of the rest

of the uterus failed to reveal any extension of the tumour either locally or at a distance.

The cervix showed a few Nabothian follicles and slight chronic inflammatory change, with patches of squamous metaplasia in the endocervix. A few simple follicular cysts were present in the left ovary and slight chronic inflammatory change in the left Fallopian tube.

Apart from an attack of acute bronchitis and asthma, convalescence was uneventful and the patient was discharged well on 31st December, 1950. Subsequent examination at the outpatient department in March 1951 showed that her general condition was good and no gynaecological abnormality was detected.

Comment

Squamous epithelium has never been found in the healthy endometrium of adult women (Nicholson, 1923) though Natanson (1907) found squamous cells in the uteri of the newborn and in infants up to 2 years of age. When such squamous epithelium does occur in pathological conditions it has long been a matter of discussion whether genuine metaplasia of cylindric to stratified squamous epithelium does occur or whether as Gellhorn (1936) suggests either "aberrant" squamous cells remain in the uterus or some undifferentiated cells later develop into squamous cells. The epithelium throughout the genital tract is formed from a common type of cell in the Müllerian duct and a certain degree of interchangeability of such tissues persists, capable of exaggeration under certain conditions, viz., long-standing irritation, chronic inflammation, senile involution of the endometrium, in hyperplasia and in cancer. In malignant conditions squamous change is frequently seen, and Kaufmann (1929) quotes Veit as saying that when such an epidermoid appearance does occur in the uterus, especially in old age, it is most important to exclude carcinoma. On the other hand, the occurrence of "epidermization" in benign lesions is relatively uncommon (Novak, 1929).

In adenoacanthomata Novak and Yui (1936) claim that the squamous epithelial growth is usually a benign concomitant of a malignant cylindric cell carcinoma, but it may assume malignant characteristics of its own. Novak (1947), however, believes that it is in the adenocarcinomata of the lesser degree of malignancy that the squamous change has been most often seen, thus explaining the relatively favourable results from a therapeutic standpoint. Each case, however, must be assessed individually for malignancy having regard to its own cytological characteristics. In the case described above the regularity of the columnar epithelium, the lack of mitotic figures in both types of epithelium, and the purely local infiltration into the submucous fibromyoma, suggest that the tumour was in fact benign though theoretically malignant, as in previous accounts (see Schattenberg and Ziskind, 1940; Beecham and Friday, 1942; Dockerty, Lovelady and Foust, 1951).

Summary

An account is given of an adenoacanthoma occurring in a uterine submucous fibromyoma. Its cytological characteristics and purely local invasiveness would suggest that it was benign in type, although other published reports of adenoacanthomata have indicated their malignant characteristics.

I wish to thank Dr. J. C. Dick, pathologist, Stobhill Hospital, Glasgow, for much helpful guidance. My thanks are also due to Dr. A. Barr for use of the clinical records, and to Mr. H. W. Boot for the photographs.

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FIG. 1
Curettings, January 1948. Whorl of squamous cells in direct continuity with columnar lining of gland acinus. × 400

FIG. 2
Curettings, November 1950. Extensive areas of squamous epithelium intermingled with gland acini. × 180

FIG. 3
Section of uterus showing intramural fibroids, base of pedunculated subserous fibroid and irregular polypoid submucous tumour near fundus. × ½

G.M.R.

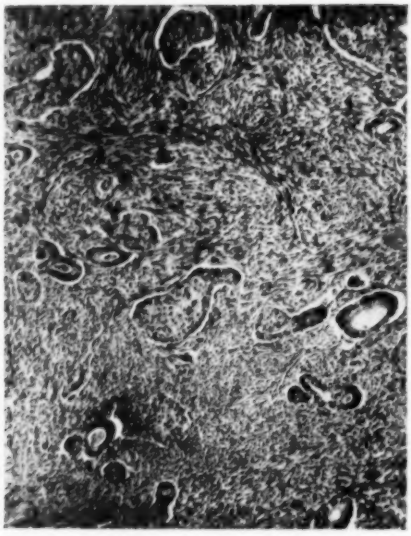

FIG. 4
Section of the (polypoid) submucous tumour containing adenomatous and squamous elements in a fibromyomatous stroma. ×80

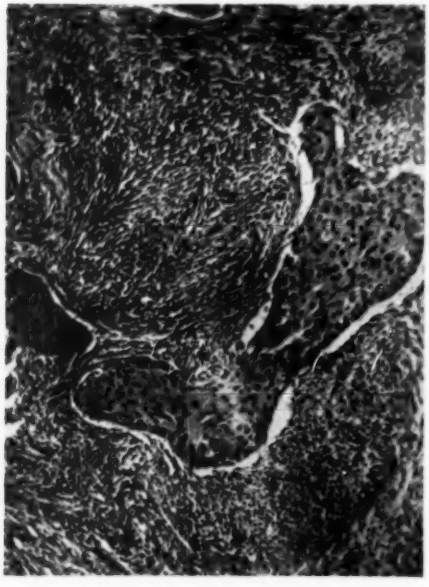

FIG. 5
Large squamous island amid fibromuscular bundles. ×130

TUBERCULOUS CERVICITIS

A Report on Two Cases and a Note upon the Natural History of the Condition

BY

TOM BARNS, M.A., M.R.C.O.G.

AND

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TUBERCULOUS cervicitis is often regarded as a late secondary manifestation of extensive tuberculosis elsewhere in the genital tract. In the following report 2 cases with this condition are described. These patients both came under observation in the Gynaecological Department of the Newcastle General Hospital during the same month of this year.

In both instances the cervical lesion was present at an early stage in the disease; on both occasions it is believed that it represented a part of a generalized haematogenous early post-primary spread of a human type tubercle bacillus, which had involved other pelvic organs simultaneously.

In the second patient (Mrs. G. C.) the cervix appeared as typically described—a florid hypertrophic lesion of the portio vaginalis, simulating in many respects a cervical carcinoma. In the other patient (Miss I. A.), however, the cervix only showed a small and superficial erosion of its surface. The finding of tuberculous cervicitis here would suggest that the condition might perhaps be found more often if fuller investigation were to be made of patients known to be suffering from endometrial and tubal tuberculosis.

The clinical histories of these 2 patients call attention to the inter-relationship which exists between the lesion found in the female genital tract, and the more general manifestations of tuberculosis which occur elsewhere in the body.

CASE 1

Miss I. A. was 15 years old. She had the menarche at 12½ years of age. She conceived on the eve of her 15th birthday. There was no history of exposure to tuberculous infection at any time during infancy or childhood. All the members of her family have been examined and found in normal health. Information concerning her consort is not available, however. The patient had left school a month before conception took place. An X-ray of her chest was taken at this time, and no lesion discovered.

The Primary Lesion

During the 8th week of her pregnancy she was admitted to hospital with symptoms of meningeal irritation. Lumbar puncture gave a clear sterile fluid, which, however, showed a high cell content (82 cells/c.mm.). This finding, taken with radiological evidence of a small non-calcified shadow in the lower zone of the right lung with some enlargement of the hilar lymph glands on that side, and in the light of subsequent serial X-rays, may be regarded as substantial evidence that a very early tuberculous lung primary developed at that time. All symptoms subsided and the girl returned home after 11 days.

At the 16th week of pregnancy the patient was re-admitted with a right-sided pleural effusion: she was toxic, febrile, and severely ill, and remained in hospital.

Antepartum haemorrhage and stillbirth within 3½ months of primary

During the 30th week of her pregnancy an antepartum haemorrhage occurred with subsequent onset of premature labour and delivery of a fresh stillborn child weighing 3 pounds. Autopsy on this foetus did not show evidence of transplacental infection. Unfortunately the placenta was not preserved.

Tuberculous cervicitis, endometritis and salpingitis within 5 months of the primary infection

Six weeks after delivery a persistent low grade pyrexia was observed. The lochial discharge continued from this time. On examination a right-sided tubal mass was felt, normal involution of uterus had taken place, and the cervix, apart from a small superficial erosion, was normal in appearance. Diagnostic curettage and cervical biopsy were undertaken, however, and showed the presence of typical miliary tubercles, frequently distributed both in the endometrium and in the cervix.

A human type tubercle bacillus was recovered from the endometrium, both by direct culture and after guinea-pig inoculation.

CASE 2

Mrs. G. C. was 25 years old. The menarche was at age 14. This patient married at the age of 20, at which time she came to live in close association with two known contacts with open pulmonary tuberculosis among her husband's relations. A pleural effusion occurred at the age of 24. Chest X-ray at this time showed evidence of an underlying primary focus in the right lung. It is highly probable that this primary lung lesion had developed during the 9 months that preceded the pleural effusion (Wallgren, 1948).

Dating from the time of her pleural effusion this patient's menstrual cycle had undergone a striking alteration; the rhythm, previously 6/28 days, changed to 11/35 days, and the loss then became increasingly heavy. This finally brought her under observation 12 months after the effusion had occurred.

Tuberculous endometritis and cervicitis, diagnosed 12 months after the lung primary

The patient was pale but her general condition was good. Pelvic examination, however, revealed a florid proliferative mass growing from the cervix, which bled to the touch, was hard, irregular and painless, and which possessed a smooth shiny surface, its appearance differing in this respect from that of a malignant neoplasm. This lesion had clearly been present for some time before this examination was made. Diagnostic curettage and cervical biopsy revealed a tuberculous cervicitis and endometritis. A human tubercle bacillus was recovered from the endometrium after guinea-pig inoculation.

DISCUSSION

During the Proceedings of the Congress of Obstetrics and Gynaecology in 1952, one of us (L.S.) has recently emphasized the probability that the lesion in the female pelvis develops during the phase of bacteraemia, which is known to occur during, and for a short time after, the development of a tuberculous primary focus, whether this focus is situated in the lung, the abdomen, or the glands of the neck. During this phase bacterial embolism to other organs may also take place, giving rise to pleural effusions, meningeal irritation, or to the presence of tubercle bacilli in the urine, etc. A study of the natural history of female pelvic tuberculosis, along these lines is at present being undertaken in this department. Confirmatory evidence that the lesion in the genital tract normally originates during this early post-primary, bacteraemic phase of the infection, is being assembled. Owing to the rarity with which primary infection is known to occur after the age of 20, it would appear that genital tuberculosis is essentially a disease of adolescence, however long it may remain latent before discovery in later life.

Our thanks are due to Mr. Hugh R. Arthur who referred to us the second case reported above and by whom the original diagnosis was made.

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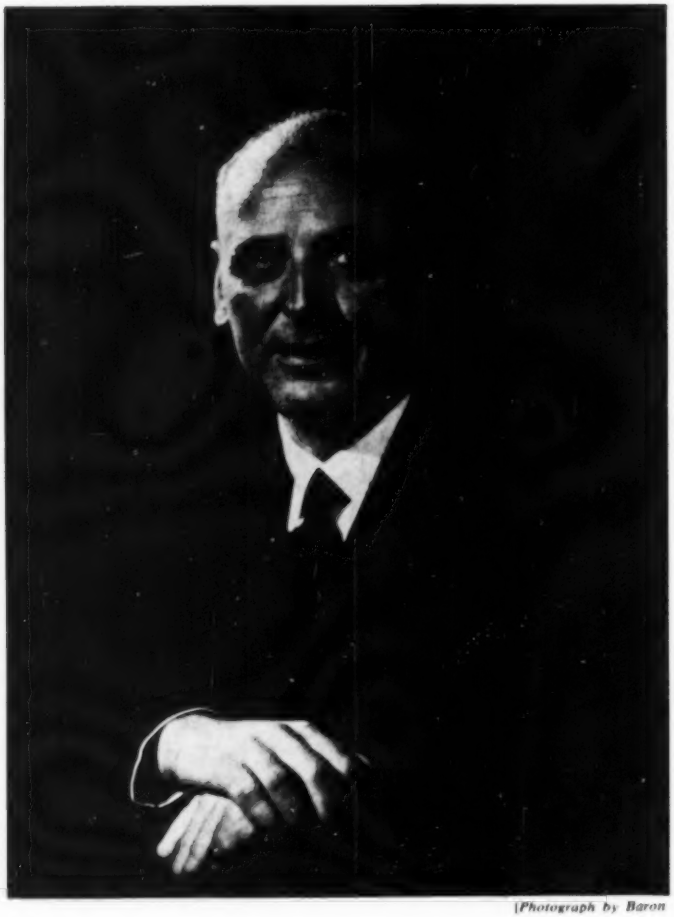

[Photograph by Baron

O'DONEL THORNLEY DODWELL BROWNE

Obituary

O'DONEL THORNLEY DODWELL BROWNE

1903—1952

O'DONEL BROWNE died in the Rotunda Hospital on 24th July, 1952, in the fifth year of his Mastership. In April he had had an attack of coronary thrombosis, but his convalescence appeared to be progressive and it was hoped he might resume part of his duties before the end of the year. It was not to be. Three previous masters had died in office—Bartholomew Mosse, the founder, in 1759; Henry Rock in July 1786; and John Pentland in 1826.

To the Rotunda Hospital and the School of Obstetrics, O'Donel Browne's death has been a grievous loss. The medical and nursing staffs of the hospital were deeply devoted to him, and to lose him at the height of his career was a stunning blow, especially as many of the plans he had undertaken were still to be completed.

He was born in Naas, Co. Kildare, on 10th April, 1903, the only son of the late Dr. H. O'Donel Browne, who had an extensive practice in the County, where he was held in regard not only for his medical skill but for his reputation as a grower of roses and as a fine all-round sportsman. O'Donel is survived by his wife, the daughter of Ernest Hastings Tweedy, by a son and daughter, and also by his mother.

He was educated at Mourne Grange Preparatory School and Campbell College, Belfast, from where he entered Trinity College, Dublin, in 1920 and qualified in medicine in 1925. He soon decided to take up obstetrics and on leaving Trinity College he was appointed Extern Maternity Assistant to the Rotunda by Gibbon FitzGibbon. The following year he became Assistant Master to Bethel Solomons. His clinical ability combined with his careful judgement marked him out, and when he completed his three years as Assistant he became attached to Sir Patrick Dun's Hospital as Assistant Gynaecologist. Six years later (1936) he succeeded the late Henry Wilson as King's Professor of Midwifery in Trinity College, Dublin, and simultaneously became Gynaecologist to Sir Patrick Dun's Hospital.

In addition to the many contributions he made to the British and Irish journals O'Donel Browne wrote an attractive textbook for students, *A Manual of Practical Obstetrics*, and this book is now going into its third edition. In 1947 his *History of the Rotunda Hospital, 1745–1945* was published. This book was widely appreciated; it provides a fascinating account of the development of the Hospital and the practice of midwifery over a period of 200 years.

The work that O'Donel Browne did to ensure the success of the Rotunda Bicentenary Congress in 1947 is well recognized. His achievement as Secretary in organizing the meetings was characteristically perfect in every detail.

During his Mastership O'Donel Browne had developed the scope of the antenatal department, and in particular the care of toxaemic patients which resulted in a marked decrease in the incidence of eclampsia. He had also initiated a revolutionary change in the treatment of eclampsia by the use of a continuous pentothal drip, and the results were published in a recent paper. His investigation of toxaemic accidental haemorrhage has opened up a new conception of this complication and stresses the necessity of early treatment in order to reduce the maternal and foetal mortality.

In 1947 Dublin University honoured him by conferring the degree of Doctor of Literature

(*Honoris Causa*), and two years later the American Association of Obstetricians, Gynecologists and Abdominal surgeons conferred their Fellowship following his delivery of the Joseph Price Oration at Hot Springs, Virginia. He had been a member of the Council of the Royal College of Obstetricians and Gynaecologists for some years, and his advice was sought on many problems both clinical and educational. He did much to further co-operation and friendship between our two countries.

He was a member of the Gynaecological Club and organized the meeting in Dublin last year. His hospitality and kindness will always be remembered.

O'Donel had friends wherever the Rotunda Hospital is known, and the deep appreciation of his qualities was instanced by the large and representative attendance at the Memorial Service held in the Rotunda Chapel.

NINIAN FALKINER

JOHN ERIC STACEY

Obituary

JOHN ERIC STACEY

1893—1952

By the death of Mr. J. E. Stacey on 9th November, 1952, the science and art of obstetrics and gynaecology has lost a skilled exponent, the Royal College of Obstetricians and Gynaecologists a wise counsellor, and the medical faculty of the University of Sheffield an experienced and popular teacher.

John Eric Stacey was born on 17th February, 1893, and was educated at Christ's Hospital. He won the open medical scholarship at the University of Sheffield, where he graduated M.B., Ch.B. with honours in 1913, being awarded the gold medal in clinical medicine and surgery. He became a resident house surgeon at the Jessop Hospital for Women at Sheffield, but when war broke out in 1914 he volunteered immediately and was posted as a combatant to the Royal Berkshire Regiment. He later transferred to the R.A.M.C. and served as regimental medical officer to the same unit. He suffered a serious spinal injury at the battle of Loos which caused a complete paraplegia, as the result of which he was bedridden for eight months. Those who witnessed the determination to recover, when once it was clear that there was hope, will never forget the supreme demonstration he gave of the influence of mind over matter. In 1918 he did most useful work as a surgeon at the Third Northern Hospital at Sheffield, standing for long periods in operating theatres with the aid of surgical appliances, and he was a source of inspiration and encouragement to many wounded soldiers. He celebrated his recovery when the war was over by undertaking a bicycle tour in Italy and the Dolomites with a medical friend.

He was determined to make obstetrics and gynaecology his career and was appointed registrar at the Jessop Hospital for Women in Sheffield.

The only higher degree in gynaecology and obstetrics at that time was the M.D. of the University of London. To obtain this he took the M.B., B.S. of London by examination in 1921 and proceeded to take the M.D. the following year.

He had obtained the diploma of F.R.C.S. (Edinburgh) in 1920. He was appointed honorary assistant surgeon at the Jessop Hospital in 1924, and full surgeon in 1935, and became senior surgeon last year.

He was also honorary consultant surgeon to the Beckett Hospital, Barnsley, and to the Retford Cottage Hospital, and was lecturer in obstetrics and gynaecology in the University of Sheffield for many years. Stacey was elected a Fellow of the Royal College of Obstetricians and Gynaecologists in 1937. He was a founder member of the College and was a member of its council from 1930 to 1937 and again from 1941 to 1947. He had been a Vice-President of the College since 1949. He was a member of the travelling club of obstetricians and gynaecologists, and last year he visited Canada and the U.S.A. as a representative of the College. During the last week of his life he was elected an Honorary Fellow of the Royal Society of Obstetricians and Gynaecologists of Athens, but unfortunately he was too ill to appreciate it.

Stacey had a wide experience as an examiner in his specialty for the universities of Sheffield and London and for the diplomas of the Royal College of Surgeons of England, the Royal College of Obstetricians and Gynaecologists, and the Central Midwives Board. He made many contributions to the literature of his

specialty and contributed the article on external female genital organs in Volume 4 of *British Surgical Practice*.

In 1951 he read a paper on "The Logical Approach to Prolapse" before the International and Fourth American Congress of Obstetricians and Gynaecologists. When the B.M.A. met at Winnipeg in 1930 he was honorary secretary of the section of Obstetrics and Gynaecology.

Eric Stacey had a vivid personality and great moral and physical courage. One of his great attributes was his fearless sincerity and determination not only to do what he himself thought was right but also to convince others to have the same opinion. He was tolerant, however, and would listen to opinions contrary to his own, and was never ashamed to confess when he had judged unwisely. In other words he was a good loser and he bore no ill will or vindictiveness towards his opponents.

After the National Health Act was on the statute book, he did his utmost to make it work in the interest of the patient. That was his paramount purpose, and it took precedence over all other aspects in any discussion.

His manner and choice of words were sometimes direct and occasionally perhaps somewhat aggressive, yet they left no offence. His logical opposition was really a great stimulant in committee meetings. To the student he was always a teacher who, though dogmatic, had a sound reason for his opinion and he would spare no pains to explain the problem. His witticisms were of great value to the successive editors of the students' magazine, but they left no sting. His students will in after-years appreciate the principles of their craft which he taught them. He had no use for sham, and he impressed on them that experience and example, combined with single-mindedness and integrity, were the most necessary qualities of a good teacher. He appealed to them all by his perennial youth.

All those who have experienced the hospitality in his home, will appreciate how much his wife, herself a medical woman, contributed to the success of his life and work. Our sympathy goes out to her and to her son and daughter at this time.

ERNEST FINCH

ROYAL COLLEGE OF OBSTETRICIANS AND GYNAECOLOGISTS

A MEETING of Council was held at the College House on Saturday, 29th November, 1952, with the President, Mr. Arthur Gemmell, in the Chair.

The Council received a grant of £3,000 from the British Empire Cancer Campaign for research purposes.

Professor Lutherus Johannes te Groen, of Pretoria University, was elected to the Fellowship.

Diaa Seif-Eldin was admitted to the Membership.

The following were appointed William Blair-Bell Memorial Lecturers for 1953:

Henry Roberts, Liverpool.

James Walker, Aberdeen.

List of candidates who have been awarded the Diploma in Obstetrics

John Fullerton Adam
Anne Alexander
Maryan Gordon Anderson
Eileen Atkinson
Margaret Aureol Austin
Pamela Mary Bacon
Geoffrey Frederick Barnes
Edith Margaret Beecher-Bryant
John Derek Belt
John Samuel Greene Blair
William Wilson Bowie
John Denys Brackenridge
Gladys Vivienne Bradshaw
John Michael Brown
Janet Carmichael Bryce
Antony Edward Robin Buckle
Michael Gareth Budden
Derek William Bull
Sheila Gwendolen Burnie
Alan Fennell Bushby
Mary Campbell-Mackie
Ian Thomas Carrie
Carmelo Cassar
David John Cawthorne
John Samuel William Chambers
Vera Choithramani
Sheila Ruth Clarke
Paul Walter Clements
June Patricia Cooper
Kenneth Veitch Cooper
John Hay Cowie
Ann Christina Coyle
Oliver Jacob Curl
John Walter Brind Dalgleish
John Knight Davidson
Hywel Francis Davies
Elizabeth Dennys
John Charles Dilley
Prabhavati Ravindranath Dixit
Frederick Brian Dobbs
Donald Joseph Dobson
Margaret Kathleen Douglas
Diana Felicity Jeyes Duncan
William Allan Webb Dutton
Gwilym Frederick Edmondson Edmondson-Jones
Mary Graham Eldridge
Wilfred Ellenbogen
James McGregor Elliott
Luba Epsztejn
Jack Eyton-Jones
Margaret Dewar Findlay
Geoffrey Robert Chevallier Fisher
Mary Lee Fraser
Godfrey Cyril Galea
Barbara Erica Gibbs
Alan Gillespie
Donald Lawrence Golightly
John Lloyd Goodger
Anne Louis Margaret Graham
David Amor Harvey Grieve
Stanley Hacking
Adrian Blurton Haigh
Ethna Jane Halpin
Ikbal Abd El-Wahid Hamdy

Marion Hanson
Henry Arthur Harding
Elizabeth Margaret Harpur
David Thomas George Harris
Helen Joanna Harthoorn
Robert Hewitt
Joseph Mitchell Hiddleston
Margaret Isabel Hill
John Angelo Holmes
John Leslie Honig
James Maitland Hood
Ralph Allan St. Clair Hoyte
Anne Luise Hunter
Anne Eleanor Jameson
Malcolm Hindmarsh Jameson
Helen Jessler
John Michael Jewitt
Guy Alwyne Horwood Jones
William Thomas Joseph
Margaret Kassab
John Anthony Nessan Keane
George Edward Kelly
Sybil Vera Kinley
Frances Elizabeth Wilson Kinnaird
Frances Eleanor Kirk
Anthony Lindsay Kirkland
Chung Yue Lai
Edward Claude Lewis
Isabel June Lim
Malcolm David Webster Low
Helen Morag Morris McCallum
John Michael Stanley McCoy
Yvette McCoy
John Anthony McCraith
Sarah Campbell McEwan
Anne Macvean McKechnie
John Gregory McKenny
Edith Mary McLean
Margaret Elizabeth Maclean
Brian Nicholl McQuade
Duncan Hunter McVie
Alexander Roy Magarey
Maureen Agnes Fitzgerald Malcolm
Marc Denis Manion
John George Markus
George Frederick Glenwell Marshall
Grahame Grant Murray Miles
John Lindsay Miller
Reuben Charles Molk
Elisabeth Monkhouse
Dewi James Rosser Morgan
June Morgan
Karl Daniel Mullen
Brendan Joseph Murphy
Salvino Muscat
John Phillips Norris
Kenneth Ross Norton
Kevin Francis O'Callaghan
Dean Wells Orton
Thomas George Osmond
Richard Bickersteth Ottley
Harry James Graham Palmer
Robert Thornton Parr
Pananghat Paul
Francis Stephen Perry
Raymond John Pett
Mary Patricia Phelan
Kamalakshi Balakrishna Pillai
Stephen John Sidney Polwin
Joan Margaret Ponsford
Frederic James Powell
Roger Beresford Prowse
Hilary Ruth Pullon
Douglas Walter Quantrill
David Joseph Harry Rogers
Annapurna Sabhesan
Prem Sarin
Rachel Daphne Rebecca Sasieni
Martin Kirby Sawday
Gordon Charles William Sharpe
Robert Wallace Simpson
Samuel Louis Skoll
Henry Stabile
Anthony James Harley Stephens
James Edward Lawrence Sutcliffe
Charles Geoffrey Wood Sykes
Peter Kirwan Sylvester
Derek Tacchi
Aly Dawood El-Tannir
Alan Richard Taylor
Joseph Taylor
James Gavin Amess Troup
Peter William Tucker
James Brian Turtle
Idris Stanley Waller
Daphne Mary Liddon Walters
Paula Mary Watkin
Joyce Manners Watson
William Leslie Whitehouse
Kathleen Mary Witham
Leonard Maurice Wolf
Elizabeth Janet Ainslie Yool

REPORTS OF SOCIETIES

NORTH OF ENGLAND OBSTETRICAL AND GYNAECOLOGICAL SOCIETY

April 1952

A meeting of the North of England Obstetrical and Gynaecological Society was held in the Radiotherapy Centre, Sheffield, on Friday, 25th April, 1952.

Dr. C. J. Dewhurst read a paper on

KYPHOSCOLIOSIS COMPLICATING PREGNANCY

(This article appears on page 76)

Professor C. Scott Russell described

A CASE OF PSEUDOMYXOMA PERITONEI

The case was that of a woman who, for 4 years, had had a pseudomyxoma peritonei; her abdomen had been opened 3 times; she had been treated with intra-peritoneal radio-active colloidal gold and, at a later date, deep X-radiation. A year ago her abdomen had burst open spontaneously with the discharge of quantities of purulent material. This discharge was still continuing and was associated with a continuing improvement in her health.

The patient, a parous woman of 50, first consulted her doctor in May 1948, because of an abdominal swelling which was thought to be a 4-months pregnancy. However, an ovarian cyst was diagnosed, and in August 1948 it was removed. The cyst was mobile and multilocular; and, though there was no mention of whether it was intact or ruptured, there was a large quantity of green-like material also present. The pathological report was " pseudomucinous cyst."

By April 1950 there was a massive recurrence of the abdominal swelling, and the abdomen was re-opened and 3 gallons of pseudomucinous material were removed. Thereafter 98 m/cs. of radio-active colloidal gold was run into the peritoneal cavity.

In October 1950 she had come under his care because of the large size of her abdomen. Considering its girth, which was 52 inches, her general condition was surprisingly good. He had performed a third laparotomy and removed 2½ bucketfuls of pseudomucinous material and an ovarian mass. Following this operation she was given X-radiation, the depth dose being estimated at 1,500 r.

In April 1951, that is 6 months after her last operation and 3 years from the time when she first consulted her doctor, her condition was only fair; the abdomen was flat, but there was considerable resistance to deep palpation, suggesting that the jelly-like material was re-accumulating, and shortly afterwards her abdomen burst open, with the profuse discharge of purulent material. She was re-admitted to hospital in poor condition. The sinus, which was at least 2½ inches long and 1½ inches in diameter, was alongside her operation scar and through it much material was escaping. She was kept under observation in hospital for a month during which time there was some reduction in the amount of discharge. Soon after her return home she developed pneumonia which was treated with penicillin. This illness seemed to have been the turning point because, although the discharge had continued until the present, her general condition had steadily improved, and she was now feeling and looking well.

Professor Scott Russell then showed a composite film of this and another case of pseudomyxoma peritonei and also demonstrated the first patient.

Discussion

The President said that in his experience the prognosis was poor once pseudomyxoma peritonei recurred.

Mr. S. Bender inquired whether her appendix had been excluded as the cause of the pseudomyxoma peritonei; but Professor Scott Russell did not know whether it had been removed.

Mr. B. L. Jeaffreson pointed out that pseudo-mucinous cysts often ruptured at operation without untoward sequel, but Dr. G. C. Paine said that there were two distinct possibilities. If only the cyst contents were spilled, there was merely a temporary reaction, but if viable epithelial cells were spilled, pseudomyxoma peritonei might occur.

Professor Scott Russell in reply said that he was still at a loss as to why the patient had improved so much since her abdomen burst.

Mr. G. W. Blomfield showed members the two million volt X-ray therapy unit and demonstrated some clinical cases. He then gave a short preliminary report on two million volt X-ray therapy in gynaecological cancer.

In the subsequent discussion there was general agreement that ideally there should be joint consultation of gynaecologists and radiotherapists in cases of gynaecological cancer, and that they should jointly conduct the follow-up clinics.

BOOK REVIEWS

"The Toxaemias of Pregnancy." By W. J. DIECKMANN. Second edition. Mosby, St. Louis, Illinois, 1952. Price £5 5*s*.

THIS massive work, which first appeared in 1941, has now appeared as a second edition. Since the first edition there has been a steadily growing volume of research into this most enigmatical disorder of pregnancy. To have sieved it all would alone have been a considerable feat, even for Professor Dieckmann, with his knowledge; but he has also quietly and systematically proceeded with his own scrupulous investigations, and the results are incorporated here.

The volume now presented is unrivalled. Barring the first edition, nothing approaching it has been produced on this subject. The new edition is 180 pages longer, and there are more illustrations and tables. The sectional index and the main index are comprehensive and detailed, so that as a reference book it is easy to use, and a veritable mine of information. Innumerable papers have been consulted, and critically assessed in the light of the author's wide experience of the subject.

The reader will naturally turn first to Chapter XIV on the factors responsible for eclampsia. And here we must confess to being dismayed to find that still there is such a long list of possible factors; their very length betrays our ignorance of the disease. *Festina lente* is perforce the motto of the researcher in eclampsia.

And herein lies the enormous value of this book, for there can be few men who, like the author, can survey the vast expanse of this subject and mould it into any semblance of order.

Some sections are outstanding. That on water and salt balance, the chapter on the pathology of eclampsia, and the discussion on prognosis, the data on maternal and foetal mortality, the review of new work on placental physiology, and Sheehan's work for example, repay the most careful study.

The book is excellently produced, and printers' errors are rare.

Everyone interested in obstetrics, teachers, and especially those who are engaged in the investigation of the problem of the toxaemia of pregnancy, cannot afford to be without this book.

"Lectures on Midwifery and Infant Care." By T. F. CORKILL. Fourth edition. Whitcomb and Tombs, Wellington, N.Z., 1951. Pp. 576, 76 diagrams; price 24*s*. 6*d*.

THIS book provides very interesting reading. A commendable feature is the concise arrangement of each lecture and the clear showing of points in practical management, particularly where nurses' duties are concerned. The diagrams which are drawn by a medical artist show many points more clearly than some of the commonly used photographs in English textbooks. The value of these sketches might have been greater if they had been arranged facing their appropriate contexts in the lectures instead of having them grouped together at the end of each lecture.

The book has been written primarily for nurses and midwives in New Zealand, and some of the management mentioned is more applicable to the New Zealand nurse than to the English pupil midwife training under C.M.B. regulations. Examples of this are found in many of the lectures, such as the recommendation that the nurse acquaint herself with the administration of ether, which practice is not allowed under C.M.B. standards, even under the supervision of a doctor. One lecture which might prove confusing to the English nurse is that on Artificial Feeding, as somewhat different methods are used in New Zealand—the Truby King method is more widely adopted over there than in this country.

Nevertheless, this is one of the most up-to-date midwifery textbooks of today, and should prove a very useful addition to any midwife's bookshelf.

REVIEW OF CURRENT LITERATURE

Owing to rising costs it has become necessary to revise the arrangements for the preparation of the Review of Current Literature. At an early date the publication of the Review will be resumed on a more limited scale.

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CONTENTS

PAGE

MODERN TREATMENT FOR VESICOVAGINAL FISTULA ... 1
Albert H. Aldridge, M.D.

RES OBSTETRICA IN THE BIBLE ... 7
Douglas Miller, M.D., F.R.C.S., F.R.C.O.G.

THE CAUSES AND PREVENTION OF STILLBIRTHS AND FIRST WEEK DEATHS (Part II) ... 17
D. Baird, A. M. Thomson, and Ethel H. L. Duncan

A CASE OF UNIOVULAR QUADRUPLETS ... 31
W. Netley Searle, F.R.C.S., F.R.C.O.G., and Frank Denny, M.B., M.R.C.O.G.

PREMATURE RUPTURE OF THE MEMBRANES ... 37
Mostyn P. Embrey, B.Sc., M.D., F.R.C.S., M.R.C.O.G.

FACE AND BROW PRESENTATION ... 44
Norman Morris, M.D., M.R.C.O.G.

ACUTE INTESTINAL OBSTRUCTION COMPLICATING PREGNANCY ... 52
A. H. Baker, M.D., F.R.C.S., Josephine Barnes, M.A., M.R.C.P., F.R.C.S., F.R.C.O.G., and Una G. Lister, M.B., M.R.C.O.G.

PREGNANCY IN ADDISON'S DISEASE ... 57
C. F. Rolland, B.A., M.B., M.R.C.P.E., J. D. Matthews, B.A., M.B., M.R.C.P.E., and G. D. Matthew, M.B., F.R.C.S.E., F.R.C.O.G.

THE GROWTH OF THE FOETAL HEAD IN THE LAST WEEKS OF PREGNANCY ... 61
I. Macdonald, M.B., D.(Obst.)R.C.O.G.

THE MALE FACTOR IN HUMAN STERILITY ... 67
Bernard Sandler

KYPHOSCHOLIOSIS COMPLICATING PREGNANCY ... 76
C. J. Dewhurst, M.B., M.R.C.S., M.R.C.O.G.

THE PREVENTION OF ECLAMPSIA: An Australasian Experiment ... 80
Sir Bernard Dawson, K.B.E., M.D., F.R.C.S., F.R.C.O.G.

SARCOMA BOTRYOIDES OF THE CERVIX ... 85
Marjorie Dunster, M.D., Ch.M., F.R.C.S., M.R.C.O.G., and Douglas Bennett, M.R.C.S., D.R.C.O.G.

SARCOMA BOTRYOIDES OF THE VAGINA AND CERVIX IN CHILDREN ... 87
A. S. Duncan, D.S.C., F.R.C.S.Ed., M.R.C.O.G., and E. Chalmers Fahmy, F.R.C.P.Ed., F.R.C.S.Ed., F.R.C.O.G.

THE ONSET OF LABOUR IN RELATION TO THE LENGTH OF THE MENSTRUAL CYCLE ... 92
K. G. Seager, M.B., M.R.C.O.G.

HERPES GESTATIONIS ... 99
J. A. McCredie Smith, M.D., M.R.C.O.G.

FURTHER OBSERVATIONS ON THE EFFECT OF DIHYDROERGOTAMINE UPON HUMAN UTERINE ACTION ... 103
Robert C. Gill, M.R.C.O.G.

MENSTRUAL CHARACTERISTICS OF WOMEN LIVING IN A TROPICAL CLIMATE ... 110
C. R. Wadsworth, M.D.

COMBINED FULL-TIME INTRA-UTERINE AND EXTRA-UTERINE PREGNANCY WITH SURVIVAL OF MOTHER AND BOTH CHILDREN ... 114
Gorachand Nandi, M.B., F.R.C.O.G.

CONGENITAL TUBERCULOSIS ... 119
J. P. McIntyre, M.D., Alison M. T. Drimmie, M.B., and W. J. Gordon, M.B.

ADRENOCORTICOTROPHIC ACTIVITY OF PLACENTAL EXTRACTS ... 123
F. G. Sulman, M.D., D.V.M., and F. Bergmann, M.D., Ph.D.

PRIMARY CARCINOMA OF THE VAGINAL VAULT FOLLOWING TOTAL HYSTERECTOMY FOR NON-MALIGNANT CONDITIONS ... 126
Marjorie Dunster, M.D., F.R.C.S., M.R.C.O.G., and Douglas Bennett, M.R.C.S., D.R.C.O.G.

ADENOACANTHOMA IN A UTERINE FIBROID ... 129
Grace M. Ritchie, M.B., Ch.B.

TUBERCULOUS CERVICITIS ... 131
Tom Barns, M.A., M.R.C.O.G., and Linton M. Snaith, M.D., F.R.C.S., F.R.C.O.G.

OBITUARY: O'DONEL THORNLEY DODWELL BROWNE and JOHN ERIC STACEY ... 133, 135

ROYAL COLLEGE OF OBSTETRICIANS AND GYNAECOLOGISTS ... 137

REPORTS OF SOCIETIES ... 139

BOOK REVIEWS ... 140